



COMMONWEALTH of VIRGINIA

Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the Eastern Shore

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I. Introduction and Background

This *Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for Virginia's Eastern Shore* reflects a continuation of Virginia's commitment to improving local water quality and the water quality and living resources of the Chesapeake Bay. With its roots in the 1983 creation of the Chesapeake Bay Program the strategy builds on previous efforts and looks to shape actions in a large and diverse watershed over the next six years and beyond. The reduction goals are far greater than any set before.

Developed as a partnership between natural resources agencies and local stakeholders, this strategy provides options for meeting ambitious reductions in nitrogen, phosphorus and sediment and outlines future actions and processes needed to maintain these levels in the face of a growing population and changing landscape.

The Eastern Shore is long and narrow with numerous small watersheds that comprise a complex system of tidal creeks, guts and inlets. About half of these watersheds drain into the Chesapeake Bay. Shore tributaries draining into the bay include the Onancock, Pungateague, Occohannock and Nassawadox creeks, and numerous smaller waterways such as the Old Plantation, Kings, Hungars, Cherrystone, Pitts and Holdens creeks. Tidal portions of these creeks are generally deeper and wider at their mouths and very shallow inland. Freshwater portions of these creeks can be very shallow and narrow, and the watersheds of the coastal creeks are small, particularly when compared with watersheds of the lower bay rivers. The creeks and streams that flow into the bay are influenced by tides thus have a more direct connection to bay waters.

A successful nutrient and sediment reduction strategy will have significant impacts on water quality in the Eastern Shore's bayside creeks and streams. Likewise, along with strategies being developed for other Bay tributaries in Virginia, Maryland, Pennsylvania, West Virginia, New York and Delaware, they will have a cumulative effect on the waters and living resources of the Chesapeake Bay.

The Bay is North America's most biologically diverse estuary, home to more than 3,600 species of plants, fish and animals. Approximately 348 species of finfish, 173 species of shellfish and more than 2,700 species of plants live in or near the Bay. It also provides food and shelter for 29 species of waterfowl, and more than one million waterfowl winter annually in the basin.

The plight and status of these species show that they will respond to the proper management practices. And that much still needs to be done.

A history of restoration

In the early 1980s, the Chesapeake Bay was a resource in severe decline. Water quality degradation played a key role in the decline of living resources in Bay and its tidal tributaries.

In 1983 the governors of Virginia, Maryland and Pennsylvania were joined by the mayor of Washington, D.C., the U.S. EPA administrator and the chairman of the tri-state legislative Chesapeake Bay Commission to sign an agreement working toward the restoration of the Chesapeake Bay. This agreement created a multi-jurisdictional, cooperative partnership known as the Chesapeake Bay Program. The program, sought to restore the Bay and its resources through shared, cooperative actions.

An over abundance of nutrients was identified as the most damaging water quality problem facing the Bay and its tributaries. High levels of nutrients, primarily phosphorus and nitrogen, over-fertilize the Bay waters, causing excess levels of algae. These algae can have a direct impact on submerged aquatic vegetation by blocking light from reaching these plants. More importantly, these algae have an indirect effect on levels of dissolved oxygen in the water. As algae die off and drop to the bottom, the resulting process of biological decay robs the surrounding bottom waters of oxygen, needed by oysters, fish, crabs and other aquatic animals.

The 1987 Bay Agreement recognized the role nutrients played in the Bay's problems and committed to reducing annual nitrogen and phosphorus loads into Bay waters by 40 percent by 2000. It was estimated that a 40 percent reduction would substantially improve the problem of low dissolved oxygen, which affects the Bay and many of its tributaries.

Nutrient reduction tributary strategies initiated

In 1992, Virginia joined her Chesapeake Bay Program partners in determining that the most effective means of reaching that water quality goal would be to develop tributary-specific strategies in each Chesapeake Bay river basin.

The tributary strategy approach is born of the realization that our actions on the land have a major impact on the waters into which they drain. This is particularly true in the 64, 000 square mile Chesapeake Bay watershed, where the ratio of land to water is 14:1. This approach also allowed stakeholders in each basin to address its mix of pollutants from point sources (i.e. wastewater treatment plants and industrial outflows) and nonpoint sources (runoff from farms, parking lots, streets, lawns, etc.).

Late in 1996 Virginia released its first tributary strategy, the ***Shenandoah and Potomac River Basins Tributary Nutrient Reduction Strategy***. The result of more than three years of work, the strategy was developed cooperatively with local officials, farmers, wastewater treatment plant operators and other representatives of point sources and nonpoint sources of nutrients in the basin. As a result of the strong support for this grass-roots approach, the 1997 Virginia General Assembly adopted the Water Quality Improvement Act to provide cost-share funding for implementation of tributary strategies.

The primary objective of the initial *Eastern Shore Tributary Strategy* process and final plan was to identify practical, cost-effective and equitable ways to reduce nutrient and sediment loads. This was accomplished by providing the best available information on

land use, nutrient and sediment loads, water quality conditions and management practices to local decision-makers. The strategy was intended to serve as an implementation guide for providing funding for identified nutrient and sediment controls. Because water quality monitoring and modeling data were not available, greater efforts were made to achieve this objective. Other objectives addressed informing citizens of factors affecting water quality of creeks and streams, and identifying ways they can restore these waterways.

The Eastern Shore Tributary Strategy process began in April 1998 with a meeting that drew state and local government officials and staff, and representatives from the Eastern Shore Soil and Water Conservation District, Natural Resources Conservation Service, Virginia Cooperative Extension, members of Citizens for a Better Eastern Shore and other concerned, private citizens. The Chesapeake Bay Local Assistance Department (CBLAD) provided the tributary strategy's team leader who coordinated the process. The strategy, which focused on the installation of agricultural BMPs, was finished in November 1999. Those involved also felt there should be increased water quality monitoring and computer modeling for the creeks.

The 1999 Eastern Shore tributary strategy includes 2003 nonpoint source nutrient and reduction targets calling for the following annual loads based on 1985 nonpoint source controllable loadings: nitrogen 1,323,500 pounds; phosphorus 77,130 pounds; and sediment 20,260 tons.

Stakeholders felt a strong need to focus on educating citizens and others on the importance of water quality on the Eastern Shore. The Eastern Shore Watersheds Network was formed to build a partnership of citizen, agencies, organizations and business to promote stewardship activities that conserve, restore, enhance and protect the Eastern Shore's watershed resources. The organization is accomplishing this by supporting community initiatives in planning, research and educational, citizen outreach. The group has written a plan for water quality monitoring and established the Citizen Epiphyte Monitoring Program and the annual Eastern Shore Watersheds Festival.

Chesapeake 2000, A Watershed Partnership

While progress was being made in removing nutrients from the waters throughout the Chesapeake Bay watershed as the result of tributary strategies, nutrient enrichment remained a problem in the Bay's tidal waters. Beginning in 1998, the U.S. Environmental Protection Agency proposed implementation of a TMDL (Total Maximum Daily Load) regulatory program under Section 303(d) of the Clean Water Act to address nutrient-related problems in much of Virginia's Chesapeake Bay and tidal tributaries. In May 1999, EPA included Virginia's portion of the Bay and several tidal tributaries on the federal list of impaired waters based on failure to meet standards for dissolved oxygen and aquatic life use attainment.

In June 2000, members of the Chesapeake Executive Council signed a new comprehensive Bay Agreement. ***Chesapeake 2000, A Watershed Partnership*** is seen as the most aggressive and comprehensive Bay agreement to date. Designed to guide the next decade of Bay watershed restoration, ***Chesapeake 2000*** commits to "achieve and

maintain the water quality necessary to support the aquatic living resources of the Bay and its tributaries and to protect human health.” Meeting this commitment through a continuation of the Bay Program’s voluntary, cooperative approach also alleviates the need for regulations to meet the same standards. However, this Multi state partnership requires strong partnerships within Virginia as well.

The new Bay agreement set out a process for achieving its water quality commitments that included setting increased nutrient reduction goals and the first Bay wide sediment reduction goals.

A living resources approach

This cooperative effort has resulted in nutrient reduction goals that are much more protective than those agreed to in the past. Bay Program partners have agreed to base their success on the attainment of water quality standards, not simply pollution load reductions. These standards strive to meet established criteria for the Bay’s designated uses. Bay partners chose designated uses based on living resources’ habitat needs – shallow water, open water, deep water, deep channel and migratory and spawning areas.

For the first time, partners developed criteria that take into account the varying needs of different plants and animals and the various conditions found throughout the Bay. The criteria are:

- **Water clarity** – which ensures that enough sunlight reaches underwater bay grasses that grow on the bottom in most shallow areas.
- **Dissolved oxygen** – which ensures that enough oxygen is available at the right time during the right part of the year, to support aquatic life, including fish larvae and adult species.
- **Chlorophyll a** – the pigment contained in algae and other plants that enables photosynthesis. Optimal levels reduce harmful algae blooms and promote algae beneficial to the Bay’s food chain.

In addition to being the focus for the reduction goals or allocations for tributary strategies, these criteria will serve as the basis for the revision of water quality standards for Virginia’s tidal waters. This regulatory action is taking place simultaneously to the tributary strategy process. A notice of intended regulatory action (NOIRA), the first step in the regulatory process to amend water quality standards, was published in the Virginia Register on November 17, 2003. The Department of Environmental Quality is using a participatory approach, to more fully involve the public, in development of the new/revised tidal water quality standards. A Technical Advisory Committee of interested stakeholders has been formed and is meeting monthly. A set of draft water quality standards is expected for presentation to the State Water Control Board early this summer, with a request to release them to the public for review and comment. Final State adoption of the standards is scheduled by the end of 2005, to become effective in early 2006, after approval by the U. S. Environmental Protection Agency. More information on this process can be found at <http://www.deq.state.va.us/wqs/pdf/NOIRABay.pdf>

Using computer models to determine allocations

To determine optimal nutrient and sediment allocations, Bay watershed partners developed several simulations for analysis by the Chesapeake Bay Watershed and Water Quality models. Each simulation, or scenario, allows Bay scientists to predict changes within the Bay ecosystem due to proposed management actions taking place throughout the Bay's 64,000-square-mile watershed.

Information is entered into the Watershed Model, which details likely results of proposed management actions. These actions range from improving wastewater treatment technology to reducing fertilizer or manure application on agricultural lands to implementing sound land use programs to planting streamside forest buffers.

Next, these results are run through the Bay Water Quality Model, which makes more than a trillion calculations and provides Bay scientists with a visualization of future Bay and river water quality conditions resulting from each scenario. Throughout the development of the new Bay water quality criteria, more than 70 Water Quality Model runs were conducted, each taking more than a week to complete.

As described above, the Chesapeake Bay Watershed and Water Quality models are powerful tools that help guide the level of effort and the types of actions needed to restore the health of the Bay and its tributaries. Understanding the strengths and limitations of these models is critical to efficiently and effectively targeting implementation efforts.

Estimating existing and future nitrogen and phosphorus loads is a key application of the watershed model. Incorporating good data and monitoring information, this model is well suited to provide these estimates.

Due, in part, to data limitations, sediment transport is simplified and sediment loads from eroding stream banks are not well captured. These limitations need to be addressed in future model versions. Moreover, these limitations need to be considered in determining ongoing implementation priorities. For example, storm water retrofits and stream restoration efforts may be more effective than is currently indicated by the model.

Regardless of certain limitations, the Chesapeake Bay Watershed and Water Quality models provide a good basis for making basing restoration decisions. Moreover, these models compliment and support other tools such as water quality assessment and watershed planning activities.

At the agreed to allocations, the model predicts that we will see a Bay similar to that in the 1950s. Proposed water quality standards will be met in 96 percent of the Bay at all times, and the remaining 4 percent would fall shy of fully meeting the proposed standards for only four months a year.

The resulting nutrient reduction goals, or allocations, call for Bay watershed states to reduce the amount of nitrogen entering the Bay and its tidal tributaries from the current

285 million pounds to no more than 175 million pounds per year, and phosphorus from 19.1 million pounds to no more than 12.8 million pounds per year. When coordinated nutrient reduction efforts began in 1985, 338 million pounds of nitrogen and 27.1 million pounds of phosphorus entered the Bay annually.

When achieved, the new allocations will reduce annual nitrogen loads by 110 million pounds and phosphorus by 6.3 million pounds from 2000 levels and will provide the water quality necessary for the Bay's plants and animals to thrive.

The Virginia tributary strategy approach

Using the modeling process described, Bay Program partners then determined specific allocations for each major basin. Allocations for basins that cover more than one state were divided by jurisdiction.

The new cap allocation for total nitrogen on the Eastern Shore is 1.16 million pounds per year, a 45 percent reduction from the actual load of 2.1 million pounds in 2002. The new cap allocation for phosphorus is 80,000 pounds, a 64 percent reduction compared to the 2002 load of 227,000 pounds. The new cap allocation for sediment on the Shore is 8,485 tons per year, a 56 percent reduction from the 2002 load of 22,036 tons. This sediment allocation does not include loading from shoreline erosion.

To reach these ambitious new reduction goals, the current strategy must build on what has gone before, in particular the 1999 Eastern Shore strategy. Many of the stakeholder groups involved in developing the previous strategy were active in working with state natural resource agency staff in crafting this nutrient and sediment reduction plan.

The strategy looks at the agricultural nonpoint source practices and wastewater treatment plant reductions that were critical to the 1999 plan to see where practices could be increased. This strategy also looks more closely at measures involving land use, urban nutrient management and stormwater management that will need to play key roles in meeting the new basin allocations.

This strategy identifies a number of nonpoint source best management practices and point source treatment levels that can be implemented to meet the York's allocations. However, the strategy also recognizes the need for reduction efforts to grow and expand in order to meet the 2010 goal and to maintain or cap the allocation once it is achieved. In short, implementation plans that improve local water quality throughout the Chesapeake Bay basins will be a continuous process into the future.

In this regard the strategy outlines processes that need to be developed in order to facilitate implementation between now, 2010, and beyond. . There will be annual progress updates and a more thorough, Bay-wide evaluation of advancement towards the 2010 goals when the updated version of the new Watershed Model becomes available, which is expected in 2006.

Implementation planning as outlined in this strategy will be continually refined, addressing both point and nonpoint sources. It must identify roles and responsibilities for federal, state and local governments, the private sector, nonprofits and the average citizen. The strategy addresses the need to establish timeframes and make cost estimates and identify potential funding sources.

Tributary strategy implementation will be an iterative process bringing greater consideration of water quality issues to many sectors in each community as time goes by. Recognizing how land use and lifestyle can impact water quality, and finding alternatives to reduce those impacts, are objectives of tributary strategies. Marketing social change of this magnitude is a challenge that Virginia will deal with steadily using a variety of approaches. Reaching millions of individuals with these messages will take time and money, and there must be enduring popular support among the citizens and elected leaders across the watershed.

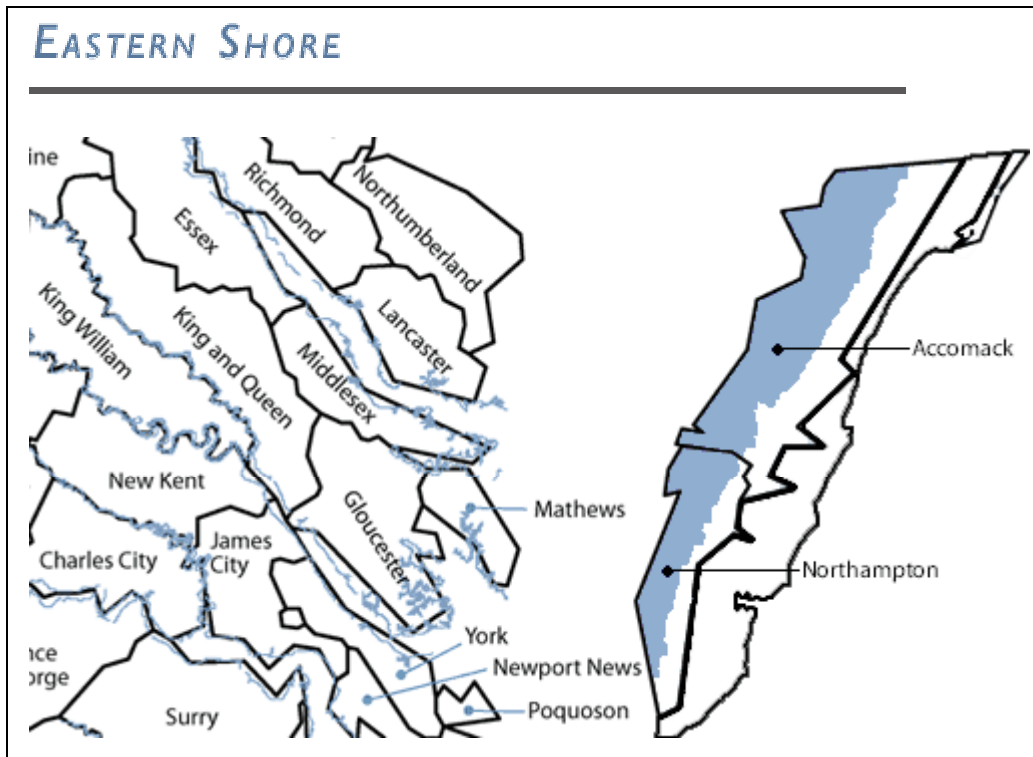
Ongoing tributary strategy implementation cannot be seen as a process that is separate from other ongoing water quality initiatives. In fact, tributary strategies should be seen as a way to connect and incorporate local water quality initiatives.

For example, many counties, some aided by local conservation nonprofit organizations, are developing local watershed management plans in their communities. These plans look at sub-watersheds of the tributary as a whole when planning new development or assessing other impacts on land and water resources. Planning at this scale reveals where individual BMPs are needed within each community in the basin. Locations for the many nonpoint sources BMPs in the tributary strategy can be determined using this technique. These local watershed plans can play key roles as a part of the implementation for a basin wide tributary strategy.

Likewise, mandated plans to restore stream segments on the federal impaired waters list, known as TMDLs (Total Maximum Daily Loads) can also be part of a larger tributary strategy. These TMDLs deal with stream segments that violate water quality standards for specific impairments such as bacteria, pH or dissolved oxygen. They do not specifically address nutrient or sediment impairments. However, the implementation plans for upstream TMDLs will also lessen nutrient and sediment loads. So, those measures included in TMDL implementation may be incorporated into the larger tributary strategy for that river basin.

roundtables, soil and water conservation districts. These regional entities, depending on location and level of involvement, are performing a variety of communication and coordination activities, some collectively and others individually.

II. Virginia's Eastern Shore Bay Watershed



Eastern Shore Bay Watershed Fast Facts

- *Drainage Area in Acres: 1,651,570*
- *Square Miles: 2,580*
- *About 6 percent of Virginia's land base*
- *Length of peninsula: 80 miles*
- *Counties: 2*
- *Towns: 15*
- *Bay Portion 2000 Population: 27,527*
- *Larger Tributaries: Onancock Creek, Pungateague Creek, Occohannock Creek, Nassawadox Creek, Old Plantation Creek, Kings Creek, Hungars Creek, Cherrystone Creek, Pitts Creek, Holdens Creek*
- *Land Use: Forest 51 percent, agriculture 38 percent, urban 6 percent.*

Virginia's Eastern Shore is an 80-mile long peninsula of approximately 696 square miles. It lies at the southern end of the Delmarva Peninsula and is bound by the Chesapeake Bay on the west, the Atlantic Ocean on the east and Maryland to the north. About half the Eastern Shore drains to the Chesapeake Bay.

The Eastern Shore is long and narrow with numerous small watersheds that comprise a complex system of tidal creeks, guts and inlets. Shore tributaries draining into the bay include the Onancock, Pungateague, Occohannock and Nassawadox creeks, and numerous smaller waterways such as the Old Plantation, Kings, Hungars, Cherrystone, Pitts and Holdens creeks. Tidal portions of these creeks are generally deeper and wider at their mouths and very shallow inland. Freshwater portions of these creeks can be very shallow and narrow, and the watersheds of the coastal creeks are small, particularly when compared with watersheds of the lower bay rivers. The creeks and streams that flow into the bay are influenced by tides thus have a more direct connection to bay waters.

Forest and agriculture dominate the Eastern Shore's land use on the bay side, and there are scattered industrial areas and more dense development around towns. Forest accounts for about 51 percent of the region's land, agriculture about 38 percent, and urban areas about 6 percent.

Major pollutants

Water quality in the Chesapeake Bay and its tributaries has been degraded by nutrient over-enrichment. Excess nutrients - nitrogen and phosphorus - stimulate unwanted growth of algae.

In 2000, nitrogen came primarily from farmland, accounting for 68 percent of the total controllable nitrogen load in the Eastern Shore's Chesapeake Bay coastal watershed. Point sources were the second largest contributor, yielding 13 percent of the total controllable nitrogen load. Forestland contributed 5.5 percent, and urban land use and septic systems contributed 4 and 3.7 percent respectively.

Phosphorus loadings also were primarily attributed to agricultural land uses. Sixty-two percent of the total controllable phosphorus originated from farmland. Point sources were the second largest contributor, with 23 percent of the total controllable phosphorus load. Mixed open and urban land uses contributed 8 and 6 percent respectively.

Another important element affecting water quality in the near shore area is sediment suspended in the water column. High sediment concentrations block sunlight needed by underwater grasses. This results in worsened feeding patterns of plankton and juvenile fish. When settled, sediment can suffocate shellfish and benthic organisms and cover hard substrate needed for attachment and growth. Within the basin, agricultural land uses contributed 84 percent of the controllable sediment load. Forestland use accounted for about 10 percent, with urban and mixed open land uses contributing about 3 percent each.

Water quality

The following sections present only a very general overview of selected water quality conditions of Virginia's Eastern Shore basins. It is difficult to adequately summarize the Eastern Shore's water quality in such a short document. Much more comprehensive and detailed analyses are available for each major Bay basin, and the reader is encouraged to supplement this brief status and trends information with several reports available through

the DEQ Chesapeake Bay Program Internet webpage www.deq.state.va.us/bay/wqifdown.html and the DEQ Water Programs' Reports webpage www.deq.state.va.us/water/reports.html.

The current status of water quality conditions, based on monitoring in 2002, is presented for the indicators most directly affected by nutrient and sediment reduction strategies. These parameters include dissolved oxygen, chlorophyll, water clarity, suspended solids, nitrogen, and phosphorus. Information about other important conditions in Chesapeake Bay (e.g., underwater grasses, fisheries, chemical contaminants) are available in the 2004 biennial report, "Results of Monitoring Programs And Status of Resources", available via the webpage for the Secretary of Natural Resources: www.naturalresources.virginia.gov.

The Virginia Chesapeake Bay and its tidal tributaries continue to show environmental trends indicating progress toward restoration to a more balanced and healthy ecosystem. However, the Bay system remains stressed and some areas and indicators show continuing degradation. Progress in reducing nutrient inputs has made measurable improvements and it is expected that continued progress toward nutrient reduction goals, along with appropriate fisheries management and chemical contaminant controls, will result in additional Bay improvements.

SAV habitat

Six sites on the Eastern Shore monitored during 2002 were located in areas considered historically important habitats for submerged aquatic vegetation (SAV): Hungars Creek, Kings Creek, Nassawadox Creek, Occohannock Creek, Onancock Creek and The Gulf, each had one station monitored in an SAV habitat.

Table 2-1. Station locations for DEQ stations monitored in historically important Chesapeake Bay SAV habitats.

Stream Name	Storet Station Name
Hungar's Creek	7-HUG001.24
King's Creek	7-KNS000.40
Nassawadox Creek	7-NSS001.62
Occohannock Creek	7-OCH001.60
Onancock Creek	7-OCN001.92
The Gulf	7-THG000.36

Dissolved Oxygen (D.O.): Average D.O. concentrations the SAV growth seasons (May-March, and September-November) were similar at all stations located in SAV habitats and well above the water quality criteria of 5 mg/L at all stations during periods considered critical to living resources.

Chlorophyll: This is an indicator of algae levels, and the annual average target for chlorophyll concentrations supportive of SAV restoration (to a depth of 1 meter) was also met on all creeks located in historically important SAV habitats during 2002.

Water clarity: Three of the DEQ stations monitored in the SAV habitat areas (Kings Creek, Onancock Creek, Occohannock Creek) had water clarity data associated with them. Average secchi depths during SAV growth season for Kings Creek and the Onancock Creek met the SAV criteria for 1-meter restoration while the Occohannock Creek did not. However, at each site the water clarity did not meet the 1-meter restoration criteria during some of the months sampled during the SAV growth season.

Total Suspended Solids (TSS): With the exception of the Occohannock Creek station, average TSS concentrations for stations located in SAV habitats met the criteria for 1-meter restoration goal. However, as with water clarity, four of the six stations did not meet the criteria during one or more of the months considered critical to SAV growth in 2002 (Fig 13b). TSS concentrations can vary greatly depending on the levels of wind-mixed resuspension of inorganic mineral particles, planktonic organisms and detritus in the water column.

General water quality

In addition to the monitoring related to SAV habitat, in 2002 DEQ monitored 89 sites on 60 creeks of the Eastern Shore as part of its long-term ambient water quality monitoring program and special studies. Thirty-nine of those sites are located in tidal creeks draining into the Chesapeake Bay with the remaining 50 sites located in tidal creeks and embayments draining into the Atlantic Ocean.

Comparisons were made of the average D.O. concentrations for two groupings -- Eastern Shore Bay and Eastern Shore Seaside stations. Average concentrations were well above levels considered stressful to aquatic life in both station groupings. Concentrations were higher in Eastern Shore Bay stations (7.2 mg/l) compared to Seaside stations (6.7 mg/l), where lower dissolved oxygen concentrations most likely occur due to the decomposition of organic matter produced in the very extensive marsh wetlands there.

The average TSS concentrations were slightly lower for the Eastern Shore Bay tributaries (17 mg/l), compared to the Seaside locations (21 mg/l). The higher TSS levels in the Seaside stations are likely due to natural, continuous resuspension of materials from the extensive marsh surfaces and shallow water lagoons through a combination of tidal forces and wind.

Average nitrogen concentrations for the Eastern Shore Bay and Seaside stations were also analyzed. Average total nitrogen concentrations of the Eastern Shore Bay sites were lower (1 mg/l) than the Seaside (2 mg/l), but both these areas had higher average values than comparable small coastal areas along Virginia's Western Shore of the Bay (0.75 mg/l). The forms of nitrogen differed greatly between the Eastern Shore groupings, with the Bay sites primarily composed of organic nitrogen and the Seaside dominated by inorganic forms (nitrate + nitrite). A likely source of inorganic nitrogen is surface runoff and groundwater from agricultural areas since the Eastern Shore is largely comprised of agricultural and forested lands. Although the average values appear somewhat low, there are individual Bayside creeks that had total nitrogen values 18-25 times higher than the average (notably Sandy Bottom Branch), primarily in the form of inorganic nitrogen.

As with total nitrogen, average phosphorus concentrations in Eastern Shore Bay tributaries (about 0.2 mg/l) and Eastern Shore Seaside tributaries (0.15 mg/l) are greater than those found in the Western Shore Bay (0.075 mg/l) and are probably also a result of agricultural activities. As noted above, agricultural land use contributes the majority of nutrient loads from the Eastern Shore, and there has been a steady increase in poultry operations over time within the watershed. Again, Sandy Bottom Branch Creek and unnamed tributary to that creek had unusually high levels of total phosphorus (4.5 - 5.5 mg/l). These creeks have been listed by the State as "impaired waters", for exceeding the nutrient screening value for total phosphorus.

Chlorophyll concentrations were higher in the Eastern Shore Bay sites (19 ug/l) compared to the Seaside tributaries (10 ug/l). The Eastern Shore Bay sites have lower TSS concentrations than the Seaside and thus better water clarity, which may allow for better phytoplankton growth.

III. Building on Past Accomplishments

The Bay Program partners established the year 1985 as the baseline from which all nutrient and sediment reductions would be calculated resulting from implementation of Best Management Practices (BMPs). Several significant benchmark years have been identified to include 1996 and 2000, 2001 and now 2002. 1996 was used as the benchmark year for the original tributary strategy and 2002 is the benchmark year for the revision process. The findings of these evaluations indicate that the voluntary implementation of BMPs resulted in meaningful and tangible progress in all sectors. However, as the benchmark years indicate, the rate of implementation and associated reductions are not sufficient to reach the recently established load allocations. During the revision process, it also became clear that the BMP tracking mechanism were omitting a significant amount to voluntary implementation efforts. Consequently, during the revision process, extensive effort by local stakeholders was made to accurately account for actual BMP implementation to date.

The 1985 baseline nutrient load is the sum of both point source discharges and the nonpoint nutrient runoff, associated with 1985 land uses in the Eastern Shore coastal basin, calculated for an average rainfall year. Estimates of nutrient and sediment loads calculated by the Watershed Model are designed to provide data that is unaffected by yearly changes in rainfall. Based on data for land use, loading rates/acre, population density, point source loads and transport factors, this report will use the calculated total and estimated nutrient and sediment loads to the Eastern Shore coastal basins for 1985, 2002 and 2010. In addition, the model has been used to calculate the relative point source loads and nonpoint source loads from major land use types for the two counties in the basin. Watershed model nutrient loading charts for the years between 1985 and 2002 for the basin are included in the following pages. The breakdowns for the two counties are provided in Appendix A.

Not all of the nutrients entering the Bay are considered to be controllable. The nonpoint source loads that naturally occur from forested areas in the basin are not considered to be part of the controllable fractions. The remaining nutrients, both from point and nonpoint sources, that enter the Bay are considered to be “controllable” to varying degrees and can therefore be reduced through nutrient reduction practices. As a result, it is critical to understand the relative land use on the eastern shore to better understand what is controllable.

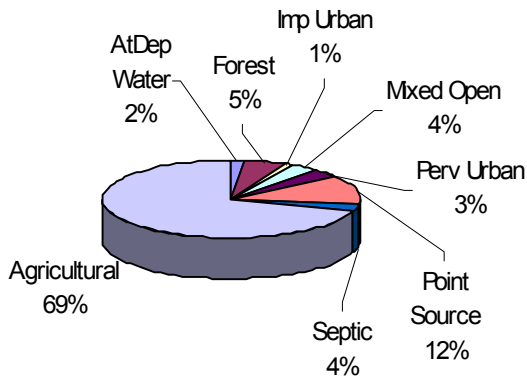
Understanding that more than 44 percent of the land on the Eastern Shore has been and will likely remain forested, and approximately two percent is open water, there is less than 54 percent of the land that controllable load reductions can be achieved.

Historical Trends

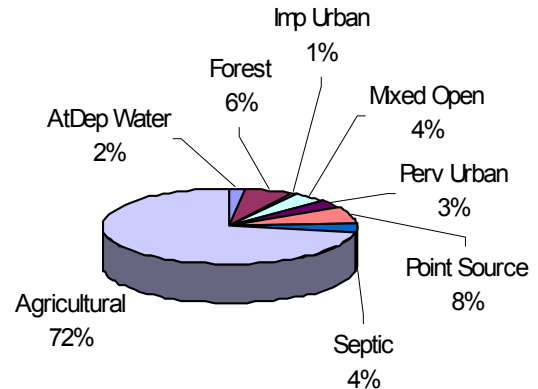
Nitrogen. In the base year of 1985, the total nitrogen load from the Eastern Shore was estimated to be 2,472,500 pounds. Agricultural crops were the largest contributor of controllable nitrogen loads in the coastal basin accounting for 69 percent of the total nitrogen load. Point sources (municipal sewage and industrial wastewater plants) were

the second largest contributor, with 12 percent of the controllable load. Urban land uses and septic systems contributed a combined 12 percent with other forest activities only adding about five percent. In 2002, the total nitrogen load had been reduced to 2,122,900 pounds (about a 14 percent decrease). There was a minor increase in controllable nitrogen load from agricultural land uses, which accounted for 72 percent of the total load of nitrogen. Point sources increased the percentage of controllable nitrogen slightly to 8 percent of the total load. Urban land uses continued to contribute approximately 12 percent of the load. The decrease in point source loads is attributed primarily installation of a nitrogen reduction system at the Tysons-Temperenceville plant, which is the largest contributor to the point source nitrogen load.

**Eastern Shore 1985 Percent of Total Nitrogen
by Land Use**

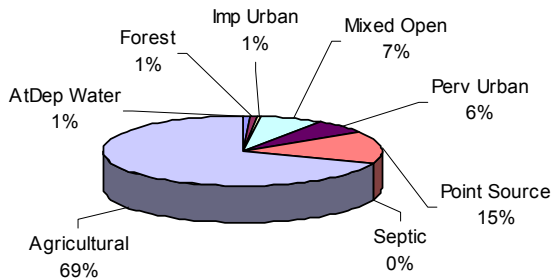


**Eastern Shore 2002 Percent of Total Nitrogen
by Land Use**

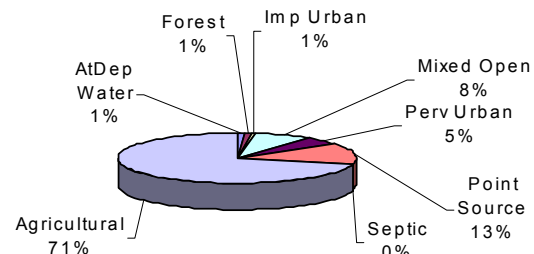


Phosphorus. In the base year 1985, the total phosphorus load from the Eastern Shore was estimated to be 266,250 pounds. Agricultural sources were the largest contributor of controllable phosphorus loads at 69 percent in the Eastern Shore coastal basin. Point sources accounted for about 15 percent of the total phosphorus load. Urban and mixed open land uses accounted for 7 percent each, with forests contributing around 1 percent. In 2002, agricultural sources remained the largest contributor of controllable phosphorus at 71 percent, while point sources decreased slightly to 13 percent of the load. The decrease in the phosphorus load from point sources is attributed primarily to installation of a phosphorus control system at the Tysons-Temperenceville plant to meet a permit limit, and the phosphate detergent ban that went into effect in 1988. Urban land uses exhibited a slight decrease reflecting 14 percent. While urbanization has increased, the decrease is attributed to the increase of sewage hook-ups.

Eastern Shore 1985 Percent of Total Phosphorus by Land Use

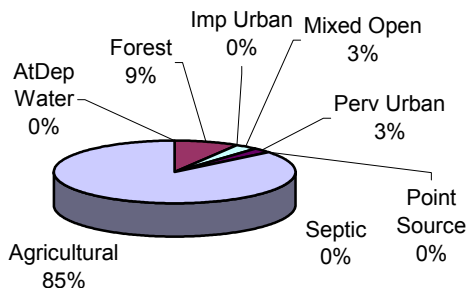


Eastern Shore 2002 Percent of Total Phosphorus by Land Use

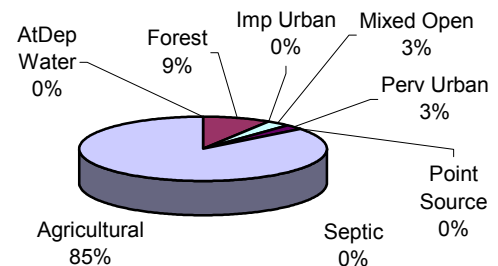


Sediment. In the base year of 1985 and again in 2002, agricultural sources contributed the dominant controllable sediment load at 85 percent. Urban land uses accounted for about 6 percent with forests contributing around 9 percent in both years. While there was essentially no change in the percentage of contributing land use categories, it is suspected that these figures do not adequately represent the urbanization on the Eastern Shore.

Eastern Shore 1985 Percent of Sediment Loads by Land Use



Eastern Shore 2002 Percent of Sediment Loads by Land Use



As mentioned previously, the above charts represent the tracked BMPs applied to the land uses identified and the relative load reductions. During the tributary strategy revision process, extensive work was performed by the local stakeholders to identify current, on the ground, implementation of accepted BMPs. This resulted in a significant increase of implementation above what was identified in the 2002 progress numbers. In that the “ground-truthed” implementation has not been run through the watershed model, it

cannot be directly applied to the 1985, and 2002 progress sets provided herein. These implementation numbers will, however, be incorporated into the 2003 progress run. It is anticipated that the progress run will be complete and available in the summer of 2004. However, the enclosed chart represents the general degree of offset from the 2002 progress run acres covered by BMPs and the 2003 “ground-truthed” numbers. Due to time constraints, this evaluation was not performed on all BMPs only the key agriculture BMPs where local stakeholders were able to accurately assess the voluntary implementation. Consequently, on those BMPs where accurate numbers were collected are included in the chart.

Table 3-1: 2003 Voluntary BMP implementation comparison

AGRICULTURAL	Units	2001	2002	2003 “ground-truthed” #
Conservation Tillage	acres	24,568	0	42,130
Cover Crops	acres	3,043	696	1,670
Riparian Forest Buffers	acres	115	6	2,286
Riparian Grass Buffers	acres	412	58	979
Nutrient Management	acres	29,300	3,946	37,969

The above numbers for 2001 and 2002 reflect what was actually tracked through the Agricultural BMP Cost-Share Tracking system and does not, nor has it, ever reflected voluntary efforts by the agricultural community. The “2003 ground-truthed” numbers exclude any BMPs tracked through the cost-share programs during the same year. Through this revision process, it has been clearly demonstrated that a significant amount of conservation practices are being implemented beyond the cost share programs. The incentives for this are primarily economic, however, when feasible, many are implementing exclusively due to a conservation ethic. These numbers, once validated and verified through QA/QC will be incorporated into the final 2003 implementation numbers for the 2003 progress.

The progress to date on the Eastern Shore has been greater than originally projected; however, more is needed to reach the goals. The momentum gained will be critical to increase both the coast-shared and volunteer implementation of these BMPs.

Monitoring efforts

In the development of the initial *Eastern Shore Coastal Basins Tributary Nutrient Reduction Strategy* it was difficult to characterize local water quality status and trends due to the limited amount of monitoring data. It was the opinion of participants in the development of the initial 1999 Eastern Shore Strategy that a comprehensive water quality monitoring program be developed for the Eastern Shore so that in the future, nutrient and sediment reduction efforts could best be targeted to address specific water quality problems.

Since 2001, the Eastern Shore Watersheds Network has been engaged in research, education and outreach activities to address water quality objectives and goals common

to the Tributary Strategy Program and the Chesapeake 2000 Agreement. As part of the research component of this effort, the Virginia Institute of Marine Science (VIMS) initiated a water quality-monitoring program in 2001 in six tidal creeks on the Chesapeake Bay side of the Eastern Shore.

This water quality monitoring program seeks to establish baseline estuarine water quality conditions in Accomack and Northampton Counties and to identify relative nutrient inputs from ground water, the Chesapeake Bay, and stormwater runoff. Frequent monitoring in surface waters established background levels of nutrients, chlorophyll *a*, and suspended solids. Groundwater monitoring helped establish typical water quality profiles associated with different land uses. Data indicated that problems with water quality likely originated from non-point source pollution in the watershed rather than from the Bay waters. VIMS identified land use change to be the most significant factor likely to affect water quality in the future and initiated a study to model the effects of development on water quality in Cherrystone Inlet in Northampton County. Results from this study will establish the relationship between pollution loadings from broad-scale land use change in the watershed and the subsequent changes in water quality in the receiving tidal creek. Locally, good water quality is essential to the ecological function of the creeks and to those who rely on its resources, including the multi-million dollar clam aquaculture industry.

Researchers at the Virginia Institute of Marine Science (VIMS) believe that the new state water quality goals that require significant reductions in nutrients and sediments can be met and maintained more efficiently on the Eastern Shore if a water quality-monitoring program is linked to land use practices at the watershed scale. A water quality-monitoring program alone will document existing conditions but will not provide the information required to improve them or to prevent future degradation. The Eastern Shore Soil and Water Conservation District (ESSWCD) administers programs that seek to reduce non-point source pollution through the implementation of best management practices (BMPs), but does not currently have the means to evaluate the effectiveness of these programs in reducing water quality pollution. Linking a water quality-monitoring program to information about BMP coverage (urban as well as agricultural) and land use practices in the watersheds will provide a logical means of evaluating and improving water quality by targeting BMPs to areas in which they are most needed.

While more long term research and monitoring is required to better assess the unique characteristics of the Eastern Shore creeks and embayments, these findings set the foundation on which implementation can be targeted. The final report of this study is enclosed in Appendix B.

Stakeholder input and involvement

During the revision process, the Eastern Shore Watersheds Network hosted a series of stakeholder meetings where extensive local input was provided. The previous sections have discussed the contributions of the stakeholders relative to BMP implementation, monitoring and data collection, however, the stakeholders provided additional insight into

considerations for implementation on the Eastern Shore. The following considerations were proposed by the stakeholder group in an effort to sufficiently address the concerns with implementing the new strategy.

- **Flexibility of implementation:** The levels of implementation and associated Best Management Practices (BMPs) proposed in the tributary strategy are designed to reflect what is necessary to meet the goals under current capabilities, with existing BMPs accepted in the Bay Model. These do not however, reflect the realities in 2010 or the technologies identified up to that time. In fact it is highly probable new, more efficient and cost effective BMPs will be identified before 2010. Consequently, when new BMPs or implementation strategies are identified, they will be inserted in place of the less efficient, more costly BMPs currently identified to achieve the prescribed goals.
- **Resources for Implementation:** The proposed level of implementation and associated BMPs, as well as prospective BMPs and strategies requires new resources. What is presented in the 2003 progress run represents near maximum capacity of implementation for the above implementers with existing resources. In order to reach the prescribed 2010 goals, significant financial, technical, political and personnel resources will need to be identified and provided to the implementers both in the short term and the long-term. It should also be noted that the continued maintenance of existing BMPs and assuring continuance of current progress would require a secure level of funding.
- **Trading:** While the strategy outlines levels of implementation for BMPs within specified geographic regions, it is anticipated the nutrient trading within the sub-basins will be employed to achieve the prescribed goals and therefore the specified quantities of BMPs will likely shift as we progress towards the goal.
- **Capping:** Once the 2010 goal has been achieved, additional strategies will be required and re-assessed to maintain the goal and continued to improve the health of the bay and its tributaries. The considerations of growth, land use transition and maintenance of existing BMPs are all significant factors to maintaining the goals. It is anticipated that this effort will rely heavily on trading and the implementation of new and more efficient technologies.
- **Land Use:** It was noted that in several incidences, the projected land use was not consistent with current trends. Consequently, every effort will be made to better reflect actual land conversion and the subsequent BMPs applied to the revised land uses to achieve the prescribed goals. This will be addressed prior to the next strategy revision.

IV. Strategy Practices and Treatments

Nutrient and sediment allocations and reduction goals

The Eastern Shore strategy is one of five developed for Virginia's Chesapeake Bay basins. While each basin had specific nutrient and sediment load allocations to reach, they are a part of overall Virginia Chesapeake Bay nutrient and sediment reduction goals. As the result of the efforts by state staff and stakeholders in all five basins Virginia has crafted a series of strategies that surpassed Virginia's nitrogen, phosphorus and sediment goals.

Table 4-1: Allocations and Scenarios by Basin and Statewide

	TN (LBS/YR)		
	2002 Progress	2010 VA Strategy	2010 Cap Load Allocation
Potomac	22,844,023	12,589,458	12,839,755
Rappahannock	7,899,245	5,309,703	5,238,771
York	7,679,383	5,362,111	5,700,000
James	37,258,742	24,518,310	26,400,000
Eastern Shore	2,122,892	948,292	1,222,317
VA TOTAL	77,804,285	48,727,874	51,400,843
	TP (LBS/YR)		
	2002 Progress	2010 VA Strategy	2010 Cap Load Allocation
Potomac	1,951,741	1,176,908	1,401,813
Rappahannock	954,358	692,870	620,000
York	749,445	538,103	480,000
James	5,952,375	3,486,427	3,410,000
Eastern Shore	227,205	86,734	84,448
VA TOTAL	9,835,124	5,981,043	5,996,261
	SED (TONS/YR)		
	2002 Progress	2010 VA Strategy	2010 Cap Load Allocation
Potomac	720,462	403,221	616,622
Rappahannock	335,183	247,000	288,498
York	126,987	97,999	102,534
James	1,174,351	791,403	924,711
Eastern Shore	22,036	8,002	8,485
VA TOTAL	2,379,018	1,547,624	1,940,849

Strategy development

As soon as nutrient and sediment allocations were received, stakeholder teams were formed in each of Virginia's major Chesapeake Bay tributary basins to guide and assist in preparing a strategy to meet the ambitious allocations. Efforts were made to ensure that the tributary team was representative of the diverse stakeholder interests in the Eastern Shore's Bay watersheds. Team representatives include citizens, farmers, soil and water conservation districts, private industry, environmental groups, wastewater treatment plant operators, and local, state, and federal government agencies from both nonpoint and point sources of nutrient pollution. A complete listing of members and affiliations may be found in the Appendix D.

Team members worked with state staff to review existing conditions in their basin in recommending a mix of nonpoint source practices and point source treatment levels. In their work they considered the existing structure, responsibilities and workload of the governmental and private entities that would be involved in implementing these practices. They worked within the framework of existing state laws, regulations and authorities. Even assuming optimal funding their initial mix of practices came up short of the basin's nutrient and sediment load allocations.

State staff then took the stakeholders work and added practices and treatments using as its only restrictions existing technologies, land availability, animal units and other variables related only to the practices themselves. They did not factor in government responsibilities, infrastructure or availability of funding.

This analysis showed that it is feasible to meet the imposing allocation goals set for each basin. However, it also showed that considerable analysis of the barriers to implementation need to be explored and addressed. This document will begin that exploration in Section V.

Scenario results

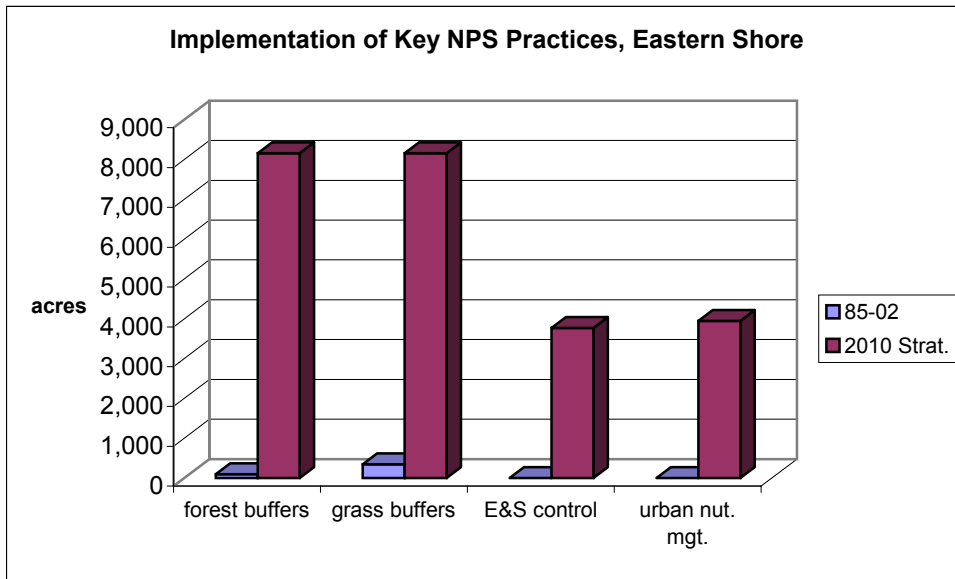
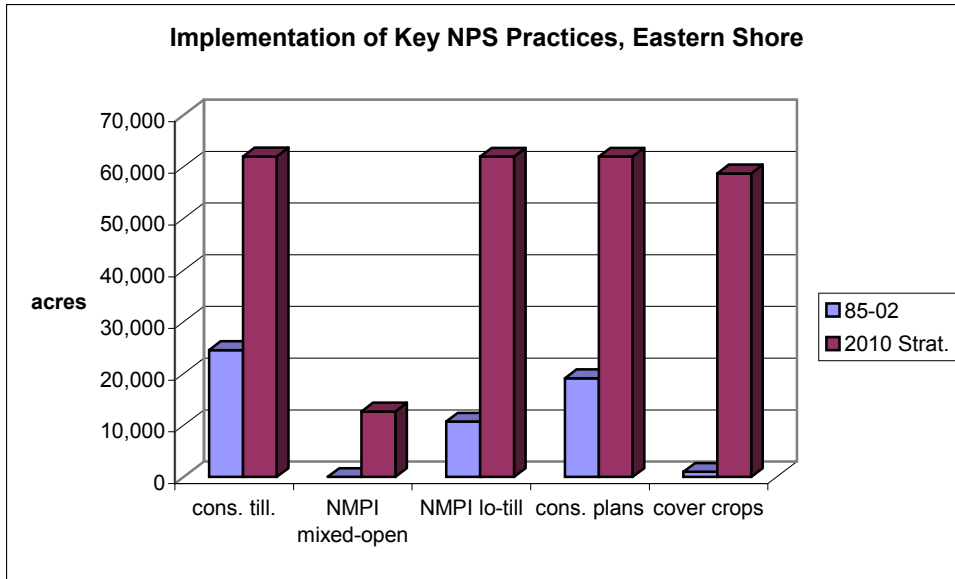
Table 4-2 presents the results from the Eastern Shore strategy process described above. It successfully meets the allocations with some overage for nitrogen, phosphorus, and sediment. In general, overages tend to occur as a result of certain BMPs that have an unequal effect on all three constituents.

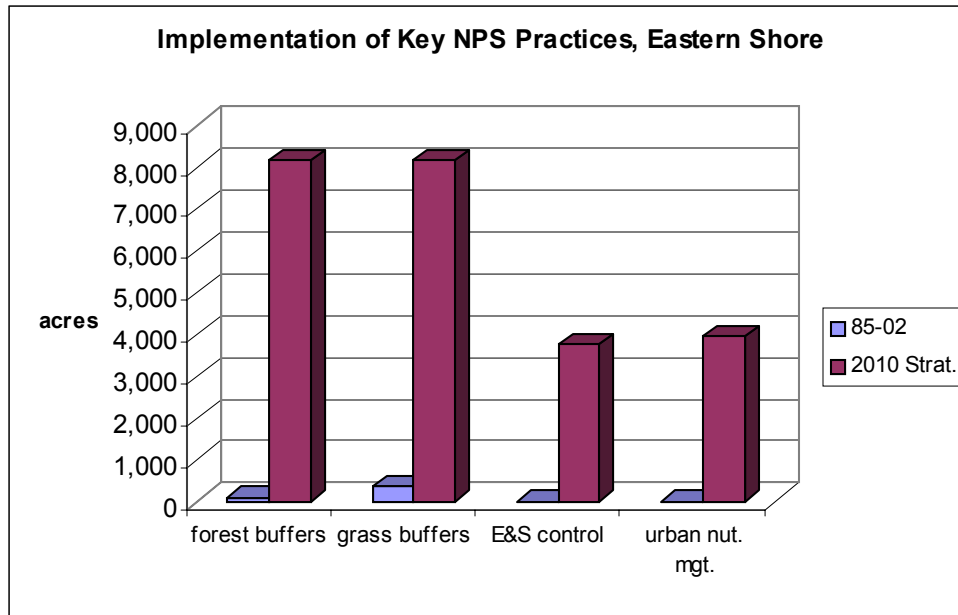
Table 4-2 – Eastern Shore Allocations

		All Sources	NPS	PS
TN (lbs/yr)	Cap Allocation	1,222,317	1,035,165	187,152
	Tributary Strategy	948,292	753,823	194,469
	2002 Progress	2,122,892	1,958,560	164,332
	1985	2,472,513	2,185,293	287,220
TP (lbs/yr)	Cap Allocation	84,448	69,733	14,716
	Tributary Strategy	86,734	82,775	3,959
	2002 Progress	227,204	196,700	30,505
	1985	232,516	226,401	6,115
Sediment (tons/yr)	Cap Allocation	8,485	8,485	
	Tributary Strategy	8,002	8,002	
	2002 Progress	22,036	22,036	
	1985	23,278	23,414	

It also shows the nutrient and sediment cap load allocations as provided by the Chesapeake Bay Program Office in March of 2003, showing the amount of nitrogen, phosphorus, and sediment that the Eastern Shore will be allocated to discharge in to the Bay yearly in millions of pounds. These limits illustrate the pollutant amounts that are believed can safely enter the Bay from the shore's Bay basin and still allow good habitat for Bay living resources such as fish and submerged aquatic vegetation. The table also provides information for nitrogen on the "baseline" established in 1985 as well as the 2002 progress to date. The 1985 baseline nutrient load is the sum of both point source discharges and the nonpoint nutrient runoff, associated with 1985 land uses calculated for an average rainfall year.

The remainder of this section will further analyze the strategy by looking at the list of recommended practices and treatments. These lists are referred to as "input decks." These input decks were submitted to modelers for use in the watershed model. The complete listing of the BMPs is provided in Appendix C. The following graphs chart the 10 BMPs with the greatest Implementation rates. A summary of both the nonpoint source practices and point sources treatments recommended follows the charts.





Input Deck summary

For the agriculture source category, the BMPs in the input deck focused on animal waste management systems, land conversion BMPs such as riparian forest buffers on cropland, hay and pasture (10 percent of available acres converted to forest buffers) and grass buffers on cropland (10 percent of available acres converted to grass buffers). Other land conversion BMPs that were targeted included wetland conversion and tree planting (10 percent of hay and pasture planted to trees). These land conversion BMPs have a greater effect on nitrogen, phosphorus, and sediment reductions with higher “pounds reduced/acre”. Also, stream protection practices (off-stream watering with fencing, off stream watering without fencing, and off-stream watering with fencing and rotational grazing were targeted. The agronomic practices such as conservation tillage, cover crops, nutrient management and farms plans were maximized, with 90 percent of the cropland in cover crops and 95 percent in conservation tillage. These practices are very cost effective and unlike the land conversion BMPs, multiple practices can be applied to a given acre that helps to increases the nutrient and sediment reductions.

The BMPs targeted for the mixed open land use included forest buffers, wetlands restoration, and tree planting with 10 percent of the available mixed open acres being restored to forest buffers, 10 percent restored to wetlands, and 10 percent planted to trees. Nutrient management planning was applied to 95 percent of the mixed open acres.

For the urban source category the stormwater BMPs that were targeted included wet ponds and wetlands, infiltration and filtering practices. These practices are more desirable than dry detention ponds and dry extended ponds because of higher nutrient removal. Forest buffers were applied to 10 percent of the pervious urban acres and 10 percent of the pervious urban acres were planted to trees. Nutrient management was

applied to 95 percent of the pervious urban acres after accounting for the land conversion practices mentioned above.

Forest harvesting practices were applied to the forest land use category. The acres treated by forest harvesting practices were based on reported data provided by the Virginia Department of Forestry.

The BMPs that were applied to the septic source category included septic tank pumpouts, and septic denitrification systems. The Chesapeake Bay Program provided projections as to the number of septic systems in operation by 2010. A septic tank pump out rate of 75 percent was used to calculate the number of pumpouts. The sewer connection totals were based on actual numbers reported by localities, and generally a 10 percent conversion to septic denitrification was applied.

The **Point Source** control levels proposed for the Eastern Shore facilities would result in annual discharged loads of about 194,500 pounds of nitrogen and 3,960 pounds of phosphorus, in the year 2010. While there are many treatment level combinations for the affected significant facilities that could reach these load levels, for simplicity and equity the input deck assumed uniform nutrient reduction treatment at the municipal plants, and equivalent controls at the industrial facility. The significant municipal plants would achieve annual averages of 8 mg/l nitrogen and 0.5 mg/l phosphorus, coupled with projected flows for the year 2010. The industrial plant would reduce their year 2000 nitrogen and phosphorus concentrations by 50 percent and 80 percent, respectively.

This scenario does not set load allocations for each individual plant -- what is sought is an aggregate point source load across the entire Eastern Shore basin that the plants would maintain into the future. The process for setting the individual plant allocations, and procedures to establish numerical discharge permit limits for nutrients will be informed and assisted under a rulemaking now underway to revise the State Water Control Board's "Point Source Policy for Nutrient Enriched Waters". Information on revising this regulation can be found on the DEQ Chesapeake Bay Program's webpage, at this Internet address: www.deq.state.va.us/bay/multi.html.

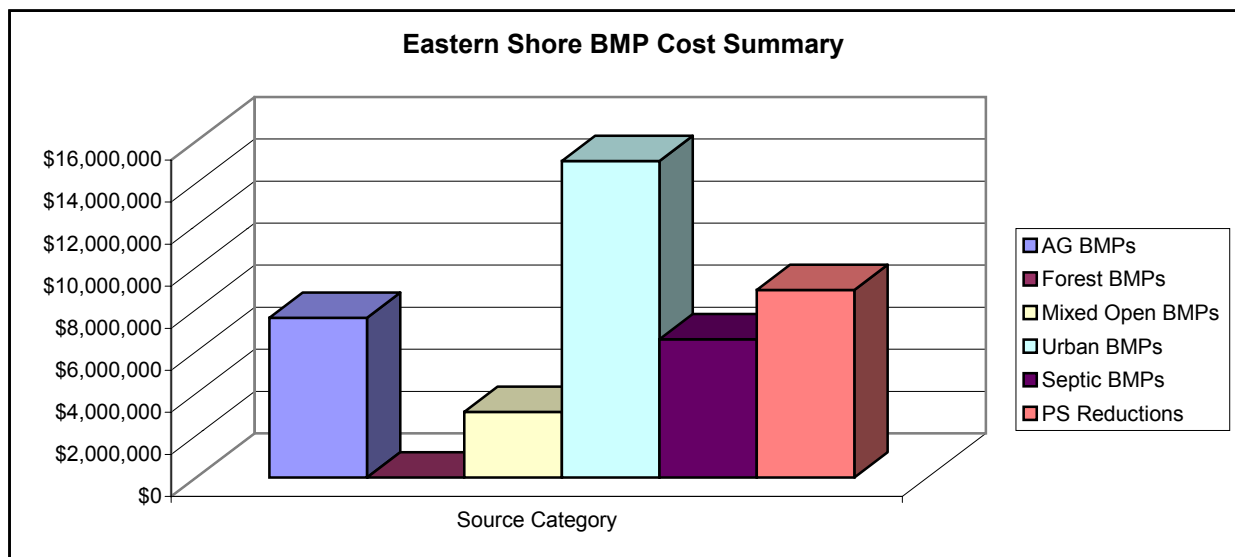
The Eastern Shore nonpoint source and point source tributary strategy input decks are provided in Appendix C.

Cost estimates

The total costs to implement the tributary strategies for the Virginia portion of the Chesapeake Bay is \$3.2 billion. The total estimated cost for the Eastern Shore basin is \$46 million. These include point sources, nonpoint sources, and technical assistance costs to implement the nonpoint source reductions required.

Cost estimates are provided for both nonpoint and point sources for each of the tributary strategy basins. They are broken down according to source category in the bar chart below. A more detailed summary is also provided in Table 4-3, showing the number of BMPs and amount of point source reductions for each basin. This table does not include the technical assistance costs calculated into the estimates above.

Cost Estimates By Source Category



Nonpoint source costs

The nonpoint source costs are based on structural costs to implement BMPs for the source categories: agriculture, urban, mixed open, septic and forest. The cost estimates considered structural costs to implement BMPs, costs for services to implement BMPs such as nutrient management planning, septic pumping, etc., and materials and equipment usage costs to implement BMPs such as the agronomic practices for agriculture (i.e., cover crops, and conservation tillage). Technical assistance costs were also calculated and added to the BMP cost to obtain the total implementation costs. (See Table 4-5) Maintenance costs were not included in the estimates.

The sources of information used to develop the cost estimates were as follows:

- Chesapeake Bay Program, Use Attainability Group Report, “Economic Analyses of Nutrients and Sediment Reduction Actions to Restore Chesapeake Bay Water Quality” (primary reference source). Urban BMP costs were taken from this source along with a small number of agricultural practices.
- Virginia’s Agricultural Cost-Share Program Tracking Database, period of record was 1998-2002. Stream fencing practices were adjusted based on 2002 data.
- DCR’s staff was consulted for nutrient management costs, erosion and sediment control costs, and the cost to transfer poultry litter.
- Study by Virginia Polytechnic Institute and State University and the United States Department of Agriculture was used for the forest harvesting practices.

The cost for the septic BMPs – connection to public sewer and septic tank pumping were based on information from nonpoint source implementation projects funded by DCR. Costs for the installation of a septic denitrification system was based on the assumption that most of the systems accounted for in the tributary strategy would be for new construction as compared to replacement of failing conventional on-site sewage disposal systems. The average cost figure for a denitrification system is \$12,565 and the average cost for a conventional system is \$4,500. The difference of \$8,065 was used to calculate the cost for the advanced treatment to obtain the additional nitrogen removal per system.

Point source costs

The point source capital costs are planning level, order-of-magnitude figures (accurate from -30% to +50%), based on a combination of owner-furnished data and results from an estimation methodology developed by the Chesapeake Bay Program's Nutrient Reduction Technology (NRT) Workgroup. This Workgroup included state and federal staff, several treatment plant owners, academia, and two experienced and respected consulting engineering firms. More accurate figures can only be determined through specific facility planning, design, and ultimately construction bids for the necessary treatment upgrades.

The NRT methodology included assumptions about treatment types, plant sizes, and needed unit processes, to reduce nitrogen and phosphorus in order to meet three annual average discharge performance "tiers":

- Biological Nutrient Removal (BNR): TN = 8.0 mg/l; TP = 1.0 mg/l
- Enhanced Nutrient Removal (ENR): TN = 5.0 mg/l; TP = 0.5 mg/l
- Limit-of-Treatment (LOT): TN = 3.0 mg/l; TP = 0.1 mg/l

It is recognized that if a particular treatment level is chosen to meet a basin load allocation in the year 2010, it is probable that more stringent treatment will be needed to maintain the reduced load into the future. This is the case where a plant has not yet reached its design capacity in the year 2010, but must "cap" its discharge load as flows increase.

The point source cost estimates were developed using the "tier" that most closely matched the proposed level of treatment in each tributary strategy planning area. As a result, it is possible that the cost figures are under-estimated. This is due to the fact that some plant owners could chose to install a more stringent treatment process now, to maintain a "cap" load at the design capacity, rather than meeting an interim 2010 load goal and potentially face multiple construction projects to retrofit their plant. The most conservative cost estimate (i.e., highest cost, associated with limit-of-treatment technology) was used only for the municipal plants in the northern Virginia portion of the Potomac basin (excepting Upper Occoquan Sewage Authority), and municipal dischargers to the tidal-fresh portion of the Middle James basin (excepting Hopewell).

Table 4-3. Summary of Costs By Source Category

Eastern Shore Basin Estimated BMP Cost Summary

Agricultural BMPs	Cost Units	Cost/Unit	Basin Costs
Conservation-Tillage	\$/Acre	\$3	\$112,357
Forest Buffers	\$/Acre	\$545	\$4,518,373
Wetland Restoration	\$/Acre	\$889	\$20,447
Land Retirement	\$/Acre	\$928	\$0
Grass Buffers	\$/Acre	\$175	\$1,343,810
Tree Planting	\$/Acre	\$108	\$27,756
Nutrient Management Plans	\$/Acre	\$7	\$213,738
20% Poultry Litter Transport	\$/Wet Ton	\$12	\$0
10% Livestock Manure Transport	\$/Wet Ton	\$12	\$0
Conservation Plans	\$/Acre	\$7	\$0
Cover Crops (Early-Planting)	\$/Acre	\$19	\$0
Cover Crops (Late-Planting)	\$/Acre	\$19	\$1,092,462
Off-Stream Watering w/ Fencing	\$/Acre	\$284	\$106,216
Off-Stream Watering w/o Fencing	\$/Acre	\$152	\$28,424
Off-Stream Watering w/ Fencing & RG	\$/Acre	\$186	\$69,564
Stream Stabilization	\$/Acre	\$12	\$0
Animal Waste Management	\$/Acre	\$32,278	\$21,772
Yield Reserve	\$/Acre	\$30	\$39,240
30% Poultry Phytase	N/A	\$0	\$0
Total Cost for Agricultural BMPs			\$7,594,159

Point Source Reductions	Cost
Phosphorus Reductions	\$334,834
Nitrogen Reductions	\$8,587,494
Total Costs for Point Source Reductions	\$8,922,328

Basin Total* **\$41,287,507**

*Does not include Technical Assistance

Urban BMPs	Cost Units	Cost/Unit	Basin Costs
Wet Ponds & Wetlands	\$/Acre	\$820	\$1,414,500
Dry Det Ponds & Hyd Struct	\$/Acre	\$820	\$0
Dry Ext Det Ponds	\$/Acre	\$820	\$0
Urban Infiltration Practices	\$/Acre	\$820	\$1,415,320
Urban Filtering Practices	\$/Acre	\$820	\$1,318,560
Urban Stream Rest	\$/Mile	\$63,360	\$0
Urban Forest Buffers	\$/Acre	\$108	\$67,824
Urban Tree Planting	\$/Acre	\$108	\$1,367,064
Urban Nutrient Management	\$/Acre	\$15	\$59,205
Urban Growth Reduction	\$/Acre	\$22	\$0
Erosion & Sediment Control	\$/Acre	\$2,500	\$9,417,500
Total Cost for Urban BMPs			\$15,059,973

Mixed Open BMPs	Cost Units	Cost/Unit	Basin Costs
Wetland Restoration	\$/Acre	\$889	\$1,691,767
Tree Planting	\$/Acre	\$108	\$205,524
Mixed Open Nutrient Management	\$/Acre	\$15	\$189,870
Forest Buffers	\$/Acre	\$545	\$1,037,135
Total Cost for Mixed Open BMPs			\$3,124,296

Forest BMPs	Cost Units	Cost/Unit	Basin Costs
Forest Harvesting Practices	N/A	\$21	\$6,631
Total Costs for Forest BMPs			\$6,631

Septic BMPs	Cost Units	Cost/Unit	Basin Costs
Septic Denitrification	\$/System	\$8,065	\$5,548,720
Septic Pumping	\$/System	\$200	\$1,031,400
Septic Connections	\$/System	\$1,500	\$0
Total Cost for Septic BMPs			\$6,580,120

Table. 4-4 6-Year Timeline, Annual Implementation Levels and Technical Assistance for Nonpoint Sources.

Date (year)	Agriculture (%)	Urban (%)	Mixed Open (%)	Septic (%)	Forest (%)	Ag. TA (%)	Urban, MO TA (%)	Septic, Forest TA (%)
1	10	15	10	15	15	10	20	5
2	15	15	15	15	15	10	20	5
3	15	15	15	15	15	10	20	5
4	20	15	20	15	15	10	20	5
5	20	20	20	20	20	10	20	5
6	20	20	20	20	20	10	20	5

Provided in the table above is a level of implementation based on a projected percentage of the total BMPs by source category that would have to be implemented yearly to achieve the tributary strategies by 2010. These percentages were used to project the structural costs on an annual basis for each of the nonpoint source categories to implement the tributary strategies. Also, included in the table is factors (expressed as a percentage) used to estimate the technical assistance costs to implement the tributary strategies. The agricultural technical assistance costs was based on 10% of the structural cost, the urban and mixed open (MO) technical costs were based on 20% of the structural costs, and septic and forestry technical costs were based on 5% of the structural cost.

The technical assistance costs are based on a uniform percentage over the six year implementation period. The percentages of yearly implementation of BMPs were adjusted to account for the expectation that the implementation levels in the earlier years will not be as great as compared to the later years due to an initial time lag. This is anticipated as a result of putting into place more technical assistance, making programmatic and regulatory changes, improving implementation reporting and tracking efforts, and obtaining substantial amounts of funding.

Table 4-5

Eastern Shore							
	Imp Yr 1	Imp Yr 2	Imp Yr 3	Imp Yr 4	Imp Yr 5	Imp Yr 6	Totals
Agriculture BMPs	0.759	1.139	1.139	1.519	1.519	1.519	7.594
Urban BMPs	2.259	2.259	2.259	2.259	3.012	3.012	15.060
Mixed Open BMPs	0.312	0.469	0.469	0.625	0.625	0.625	3.124
Septic BMPs	0.987	0.987	0.987	0.987	1.316	1.316	6.580
Forest BMPs	0.001	0.001	0.001	0.001	0.001	0.001	0.007
Agriculture TA \$	0.076	0.114	0.114	0.152	0.152	0.152	0.759
Urban & Mixed Open TA \$	0.514	0.546	0.546	0.577	0.727	0.727	3.637
Septic & Forest TA \$	0.049	0.049	0.049	0.049	0.066	0.066	0.329
Total Basin Estimated NPS Cost including Technical Assistance							37.091

* Cost in Millions of Dollars

V. Implementing the Strategies:

A Message from the Secretary of Natural Resources

This strategy and similar strategies prepared for Virginia's Chesapeake Bay tributaries propose a suite of nonpoint source best management practices, sewage treatment plant upgrades and other actions necessary to achieve the specified nutrient and sediment reductions. The analysis and practices contained in this strategy are an important first step and bring together state and regional goals informed by an understanding of local conditions as developed by the tributary teams. However, as the input decks outlined in the previous section of this document make clear, achieving the necessary implementation levels go far beyond what we have previously seen. In order for these strategies to be meaningful, we must identify what additional resources and tools are necessary to achieve and cap these nutrient reductions in the timeframe called for by the Chesapeake 2000 Agreement. We must also further refine these strategies with specific information regarding implementation budgets and timetables.

The citizens of Virginia should receive this clear message. Restoration of the Chesapeake Bay is possible but it will not come without substantial public and private resources and programs that ensure that management practices are adopted and maintained. Without such actions, the promises we have made have no meaning. Without such actions, the economic and environmental benefits of a restored bay will not be realized.

The tributary teams have raised a variety of issues regarding implementation, tracking and cost and those questions need to be addressed as we move forward. The purpose of this chapter is to build on those issues and outline in broad terms the implementation approach for these strategies. During the public comment period and beyond, the public is invited to offer comments and provide guidance on the issues and questions that follow.

Funding

Part Three of this strategy outlines the magnitude of funding necessary to address the various sources of nutrient and sediments. It is clear that implementation of these strategies will require financial resources that are far beyond those currently available. Governor Warner has proposed a dedicated source of funds for water quality improvement and land conservation, however the current stalemate in the state budget process has put the Governor's proposal as well as funds proposed by the Senate in doubt.

There is also activity at the regional level. The Chesapeake Executive Council has appointed a high level panel to address funding issues. Chaired by former Virginia Governor Gerald Baliles, the panel has begun its deliberations is expected to release its findings and recommendations in October 2004.

As part of its review of this and the other strategies, the public is invited to address the funding issue with suggestions on how additional funding can be obtained to implement this strategy. In the meantime, efforts to target existing resources will be pursued. These strategies provide the basis for evaluating the areas with greatest need.

Point source implementation

Implementation of point source reductions will be accomplished through completion of sewage treatment plant upgrades currently underway as well as final adoption of regulatory programs that are currently being developed by the Department of Environmental Quality.

Regulatory Programs Now Under Development

As described previously in this document, the EPA Chesapeake Bay Program Office published water quality criteria related to dissolved oxygen, water clarity and chlorophyll “a” that will serve as the basis for the revision of water quality standards for the states in the Chesapeake Bay watershed with tidal waters (Maryland and Virginia). The criteria, when achieved, will provide the habitat necessary to protect the bay's fish, shellfish, crabs and other living resources. A notice of intended regulatory action (NOIRA), the first step in the regulatory process to amend water quality standards, was published in the Virginia Register on November 17, 2003. The regulatory process prescribed by the Virginia Administrative Process Act is now underway. The public comment process on the proposed revisions to the standards should take place later this year.

In December 2003, Governor Warner announced the beginning of a regulatory process to establish a range of technology-based nutrient limits in discharge permits within the Chesapeake Bay watershed. The regulation will complement the water quality standards regulation and ensure that the nutrient reductions will occur. A NOIRA for this rulemaking has been published in the Virginia register and the regulatory process has begun.

These concurrent rulemakings will ensure that Virginia has the regulatory tools that define the water quality goals we are committed to achieving for the Chesapeake Bay and its tidal rivers and will serve as the basis for implementation of these strategies.

Accommodating Future Growth

The pollutant loads assigned to point and non point sources must be capped over time. The capacity of existing sewage treatment plants to handle future growth in their communities needs to be assured while at the same time not exceeding the load allocation caps for those particular plants or for an entire river basin. In addition, even if the point source regulation requires that all new plants must achieve limit of technology (LOT) treatment, there is a new load associated with even a LOT facility. Therefore, how can new or expanded treatment plants be accommodated?

Nonpoint source implementation

Nonpoint sources account for the majority of nutrients flowing into the Chesapeake Bay system and at the same time, because of their diffuse nature, they are the most difficult to control. There has been some success in addressing nonpoint sources, but the kind of comprehensive implementation necessary to improve water quality remains elusive. While existing programs, including cost-share programs on agricultural land and the Commonwealth's newly reorganized and expanded stormwater management law, will be brought to bear on nutrient and sediment pollution, better use of existing authorities and an examination of what mix of regulatory and voluntary programs are necessary must begin.

Comprehensive Management of Nutrients and Sediments on Land

The strategies rely heavily on adoption and implementation of nutrient management plans on both agricultural and urban lands. How can consistent and comprehensive application of nutrient management plans on both agricultural and urban lands be achieved?

Are there improvements that can be made to current agriculture nonpoint source control programs to better address nutrient issues? For example, nutrient management plans are currently required by poultry operations that use waste on their own lands. However, nutrient management plans are not required for those who use waste generated on other farms. How should this discrepancy be addressed?

Septic systems are currently an uncontrolled source of nitrogen. Should all newly installed septic systems and replacement systems be required incorporate processes to remove nitrogen from effluent?

Beneficial uses of animal and poultry waste must be more aggressively pursued. Value added products produced from animal or poultry waste or “waste to energy” facilities can help address nutrient issues. How can these approaches be broadly implemented in Virginia?

Buffers along streams and rivers have proven to be an effective practice to reduce nutrients and sediments. In addition to programs such as the Conservation Reserve Enhancement Program that establish buffers on agricultural lands, programs such as the Chesapeake Bay Preservation Act require buffers along perennial streams in Eastern Virginia. What can be done to accelerate the establishment of buffers along Virginia’s streams and rivers?

The placement of sewage sludge (sometimes called “bio-solids”) on agricultural lands is increasing. Are programs currently in place sufficient to address the impacts of this source of nutrients?

Land use

As these strategies recognize, the landscape is changing. Growth and development will alter the ratio of sources and conversions from less intensive land uses to more intensive uses will continue. These strategies recognize that new methods of land management, particularly low impact development practices, will need to be employed on a much larger scale. This approach must be pursued concurrently with improved enforcement of erosion and sediment control and other traditional land management practices.

How can these new land management practices become integral parts of local land use and land management programs particularly in areas outside those governed by the Chesapeake Bay Preservation Act?

Next steps

Although considerable efforts have gone into the development of this strategy, it is not complete. While we have identified the point and nonpoint source practices necessary to achieve our goals, a good deal of work with regard to the implementation of these practices remains to be done. Following the public comment period, these strategies will be supplemented with additional detail regarding implementation responsibilities, budgets and timetables. We must clearly show how each of the practices proposed can be implemented; first, by showing what existing programs can accomplish with known resources and second by showing what additional resources will be necessary to complete implementation. In addition, detailed progress reports will be made annually to the Governor, the General Assembly and the citizens of Virginia as part of the required annual report on Tributary Strategy implementation.

As the implementation of the strategies proceed, tributary teams and state agencies will assume the following responsibilities.

- Establish process to evaluate progress and success
- Establish specific timeline to achieve pollutant load allocations by 2010
- Guide and prioritize implementation activities
- Refine Input Deck as revised data become available
- Develop outreach initiatives and strategies
- Collaborate with watershed organizations to promote and guide implementation
- Help localities, Soil and Water Conservation Districts, Planning District Commissions and businesses with local and regional watershed planning

State agencies and the tributary teams will also work closely with Planning District Commissions and Soil and Water Conservation Districts and other partners in order to:

- Encourage local governments to adopt and maintain tracking systems to account for the establishment of urban best management practices
- Promote specific strategy components to localities
- Assist in the development and implementation of local watershed plans that support the strategy
- Encourage landowners to implement specific BMPs
- Provide to local governments the technical assistance and analysis of environmental data to support program development and implementation
- Provide technical GIS capability to support local programs
- Promote, coordinate and track agricultural and urban BMPs
- Facilitate consensus among localities in each PDC jurisdiction on strategy development, refinement and implementation

An interagency steering committee operating under the direction of the Secretary of Natural Resources coordinates state oversight of the tributary strategy process. The committee will:

- Re-evaluate strategies, as necessary following the adoption of new water quality standards and based on the scheduled 2007 re-evaluation by the Chesapeake Bay Program.
- Maintain clear lines of communication in state government
- Report on implementation through an annual report
- Better engage federal agency partners
- Prioritize Chesapeake 2000 Agreement commitments that facilitate or support tributary strategy implementation
- Identify data and map support needs
- Maintain and enhance state nonpoint source assessment and targeting information
- Target available funding resources
- Promote “government-by-example” activities, such as low impact design for state projects
- Provide ongoing support for local watershed planning activities
- Refine implementation timelines
- Ensure committee composition that includes needed expertise and comprehensive agency input

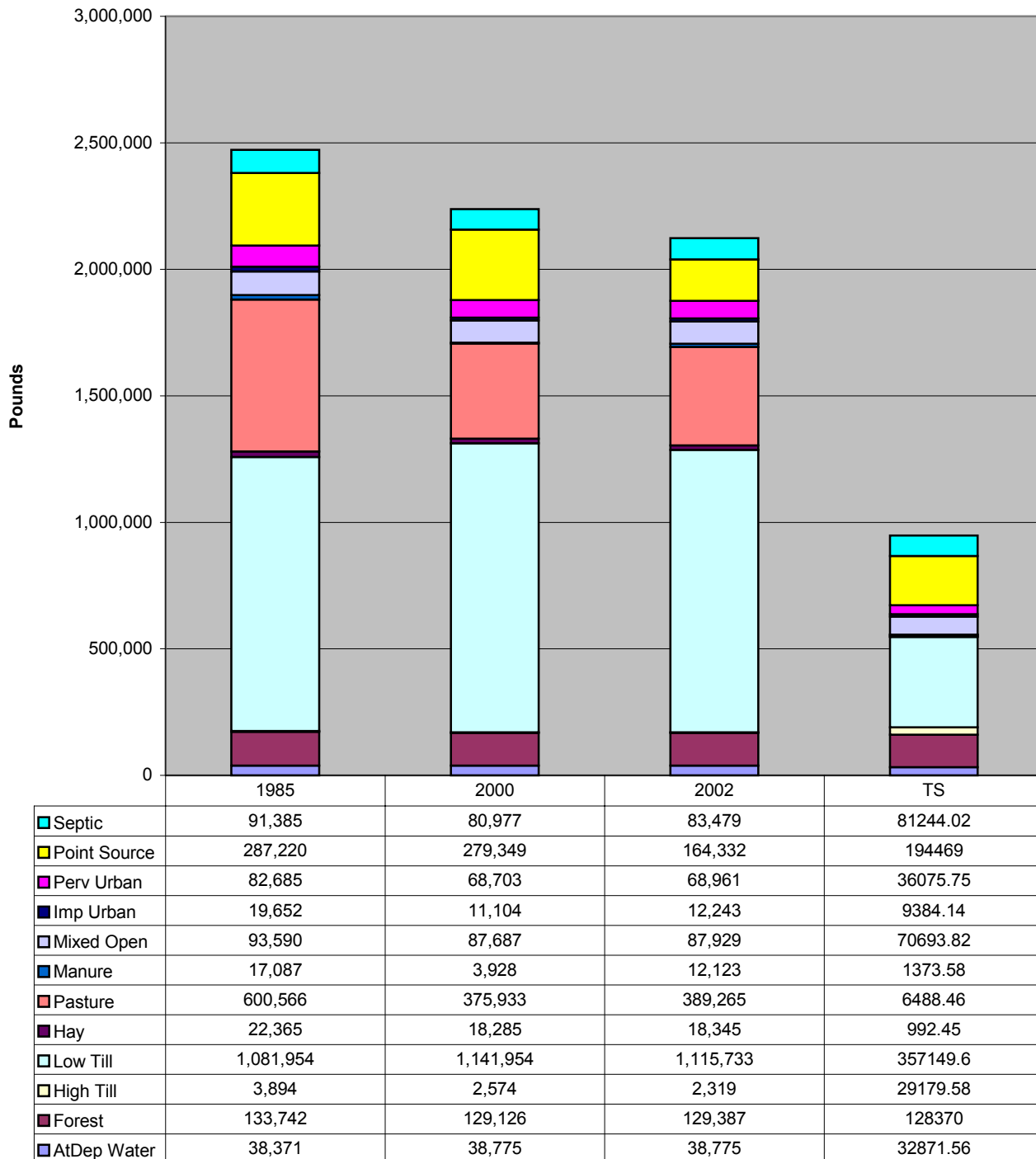
The challenge is now to turn these plans into reality and to continually refine them so they implement the most effective and efficient methods to achieve our ambitious goals.

Appendices

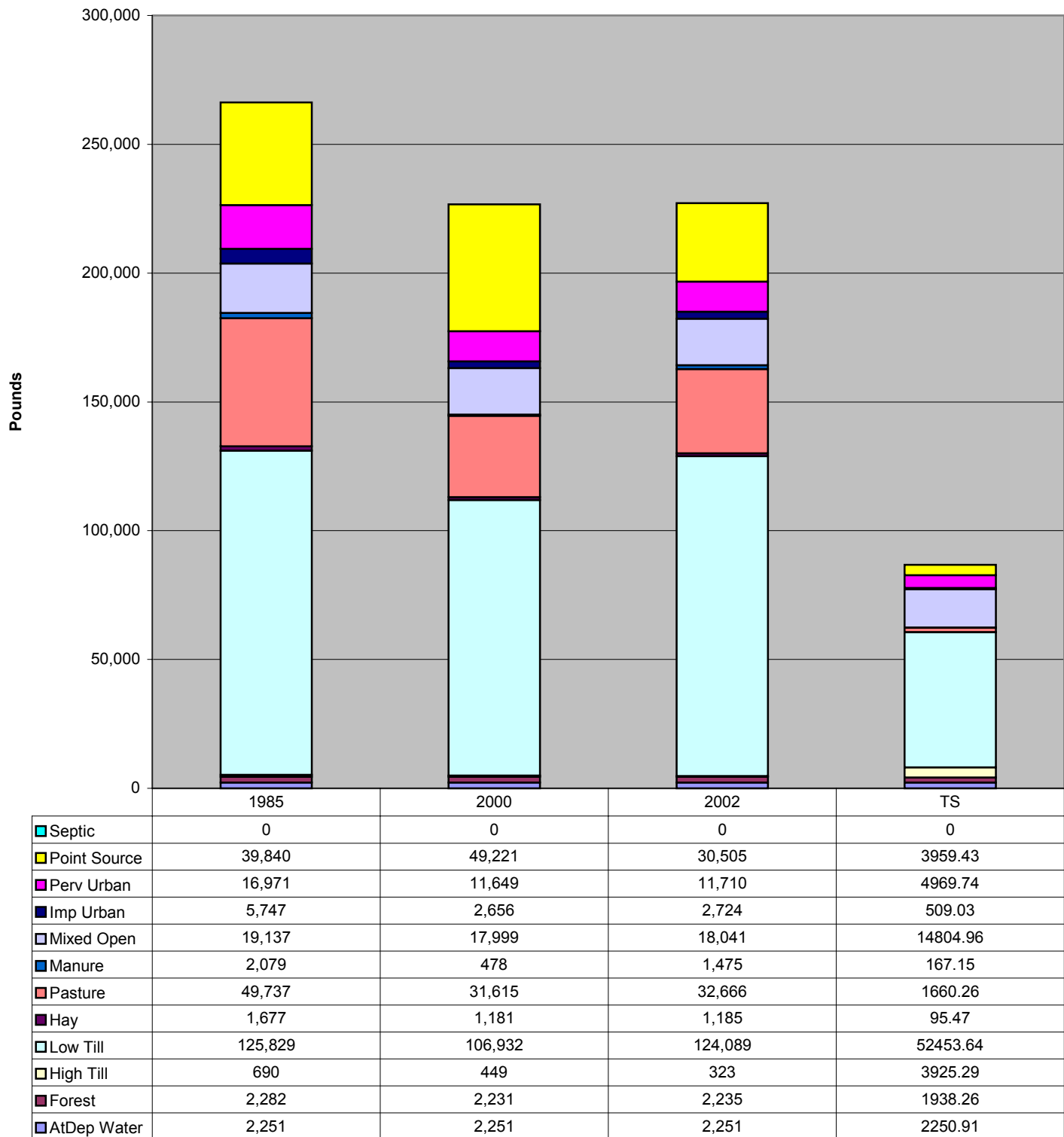
Appendix A:	Eastern Shore Source Loads	page 41
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Appendix A – Eastern Shore Source Loads

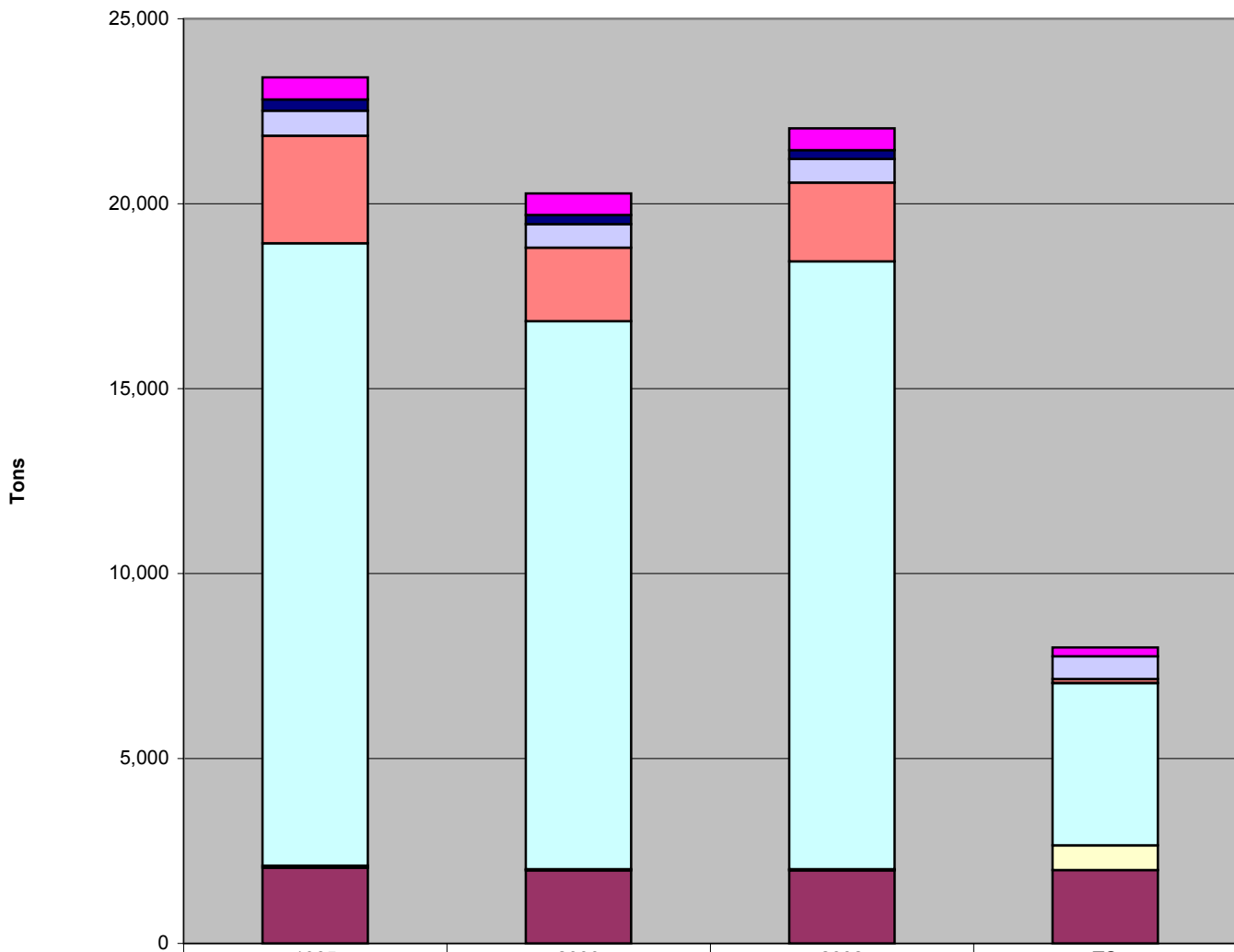
Eastern Shore - Total Nitrogen



Eastern Shore - Total Phosphorus



Eastern Shore - Sediment Load



	1985	2000	2002	TS
Septic	0	0	0	0
Point Source	0	0	0	0
Perv Urban	596	584	586	235.77
Imp Urban	302	244	237	0
Mixed Open	677	636	637	619.83
Manure	0	0	0	0
Pasture	2,909	1,989	2,139	97.82
Hay	0	0	0	12.27
Low Till	16,832	14,817	16,429	4386.64
High Till	50	31	29	665.53
Forest	2,048	1,976	1,978	1984.05
AtDep Water	0	0	0	0

Appendix B – Final Report on water quality monitoring for the Eastern Shore Tributary Strategy

Final Report

Water Quality Monitoring for the Eastern Shore Tributary Strategy Program

in conjunction with

Virginia's Eastern Shore Watersheds Network

Submitted by:

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Eastern Shore Laboratory
Wachapreague, VA

Submitted to:

Rick Hoffman
Virginia Department of Environmental Quality
Richmond, VA

September 13, 2002

Background

As part of the statewide initiative to reduce nutrient and sediment loadings in the Chesapeake Bay, the Eastern Shore Tributary Strategy Program seeks to establish baseline estuarine water quality conditions in Accomack and Northampton Counties and to identify relative nutrient inputs from ground water, the Chesapeake Bay, and stormwater runoff. Locally, good water quality is essential to the ecological function of the creeks and to those who rely on its resources, including the multi-million dollar clam aquaculture industry. The long-term objective for this local initiative is to model the effects of land use change on water quality on the Eastern Shore. VIMS has measured water quality in tributaries of the Chesapeake Bay and in select groundwater locations since January 2001. A review of monitoring activities for the six month period between January 1-June 30, 2002, funded by the Virginia DEQ, will be included in this report. All data presented will include the entire monitoring period since January 2001.

Water Quality in Tidal Creeks

Sites

Old Plantation Creek, Hungar's Creek, and Cherrystone Inlet were monitored monthly in January and February, and bimonthly in March-June. In each creek, samples were collected at upstream, midstream, and downstream sites during the last three hours of ebb tide to insure maximum influence from the watershed and minimal influence from the bay (see Figure 1 for sampling locations).

Parameters measured

At each station, Hydrolab minisondes recorded the following physical measurements of water quality: dissolved oxygen, pH, water temperature, and salinity. A LiCor light meter was used to measure profiles of photosynthetically active radiation (PAR) underwater. The LiCor light meter malfunctioned during the first sampling event in May and was returned to the manufacturer for repair. Subsequently, we were unable to measure PAR during the May and June sampling events. At each site, we collected two samples of water and analyzed each for the following chemical parameters: ammonia (NH₃), nitrite (NO₂), nitrite + nitrate (NO_x), orthophosphate (OP), total dissolved nitrogen (TDN), total dissolved phosphorous (TDP), total suspended solids (TSS), fixed suspended solids (FSS), volatile suspended solids (VSS), dissolved organic nitrogen (DON), dissolved organic phosphorous (DOP), pheophytin (PHEO), and chlorophyll *a* (CHL*a*).

Summary data

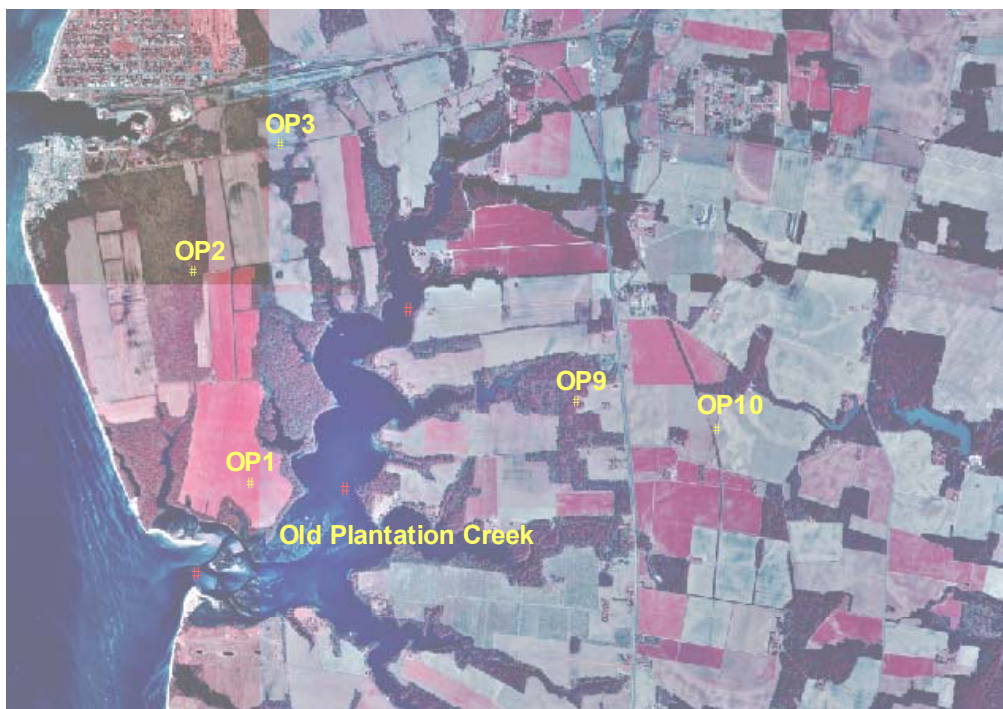
All data collected between January 1, 2001 and June 30, 2002 have been posted online at the Chesapeake Bay Program website: <http://www.chesapeakebay.net>. Metadata files, also online, include detailed site locations, protocols and analytical methodology. A QA/QC project plan for this program was filed with the Virginia DEQ. Summary statistics are presented in Appendix 1.

Figure 1 a-c. Sampling locations around a) Cherrystone Inlet, b) Old Plantation Creek, and c) Hungar's Creek are indicated. Creek stations are shown in red. The top of each figure is north and upstream for the mainstem of each creek. Wells are shown in yellow. In Cherrystone Creek, three transects of wells are depicted: EV (Eyreville), CR (Creek), and EH (Eyre Hall). Sites labeled along each transect contain clusters of wells.

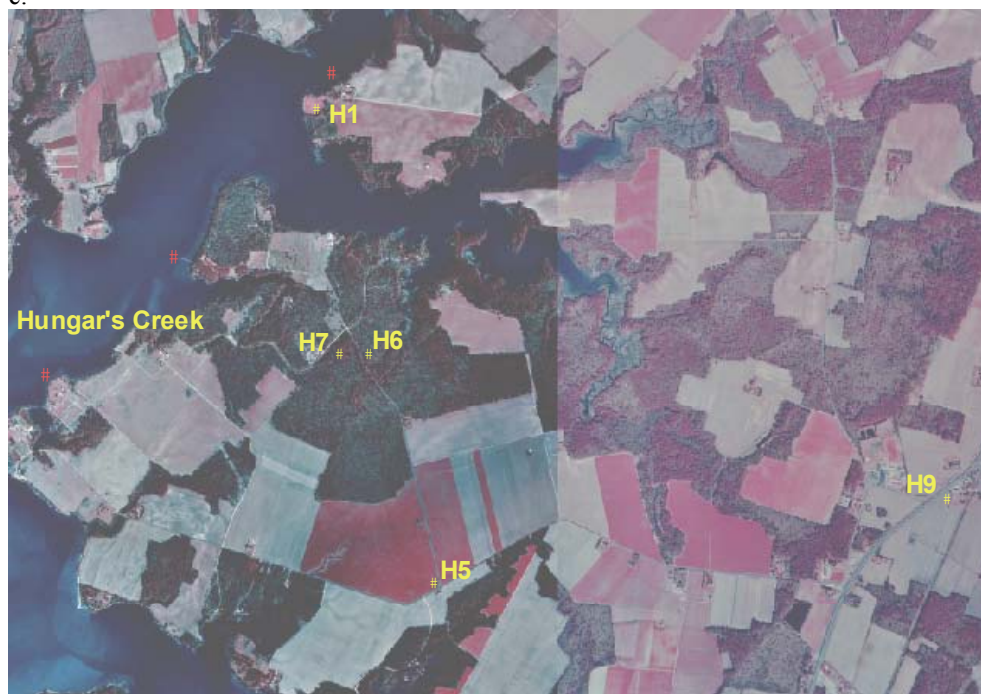
a.



b.

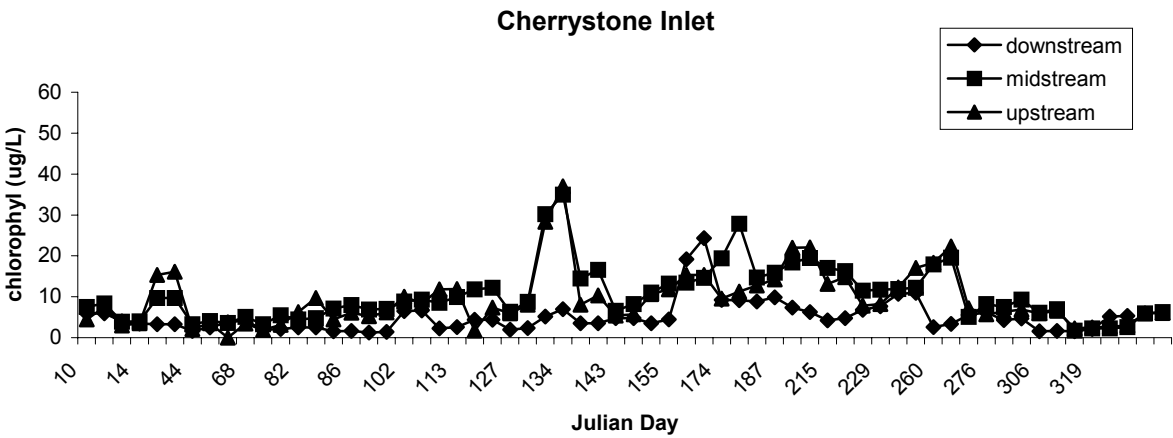


c.

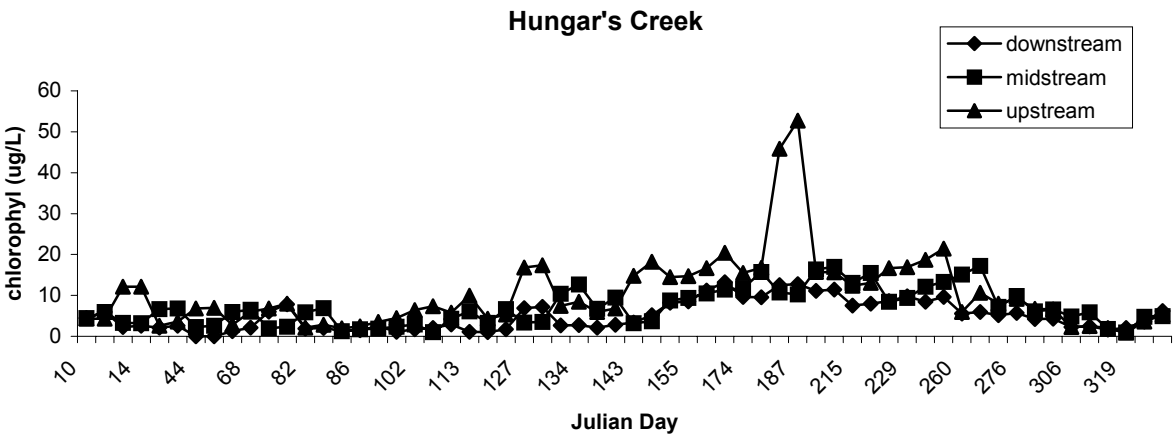


In general, levels of nutrients, total suspended solids, chlorophyll, and light attenuation were lower at the mouths of the creeks than in the midstream or upstream areas (Figures 2-5). This pattern indicates that the deleterious effects on water quality originate in the watershed and are likely to be related to land use.

Figure 2. Chlorophyll values by site. Values for each sample are represented.
a.



b.



c.

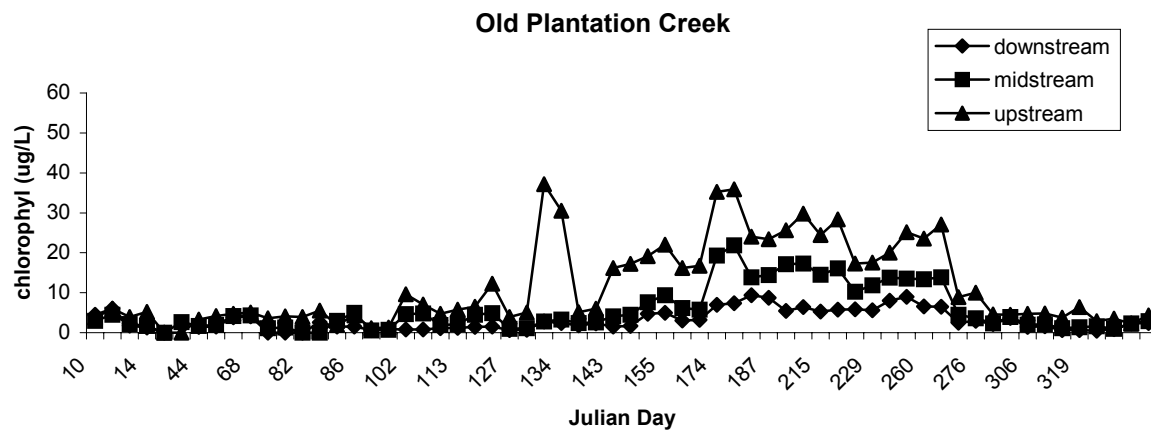
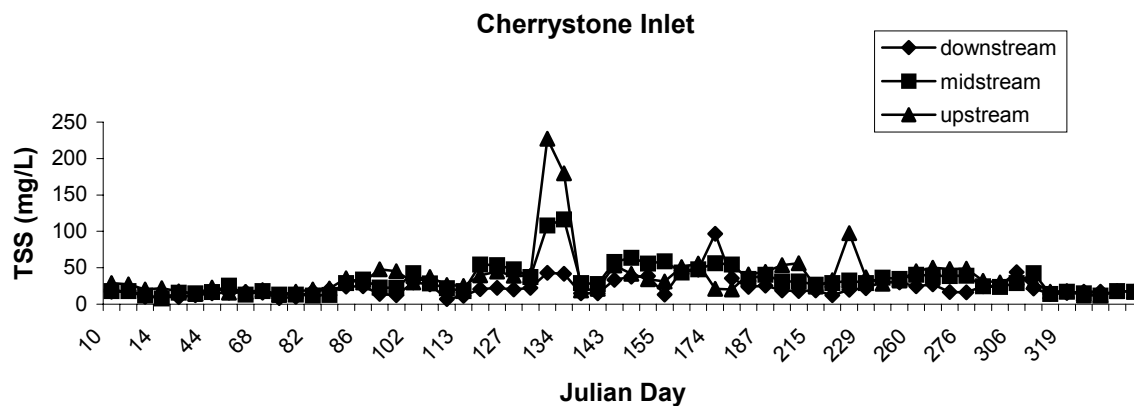


Figure 3. Total suspended solids by site. Values for each sample are represented.
a.



b.

c.

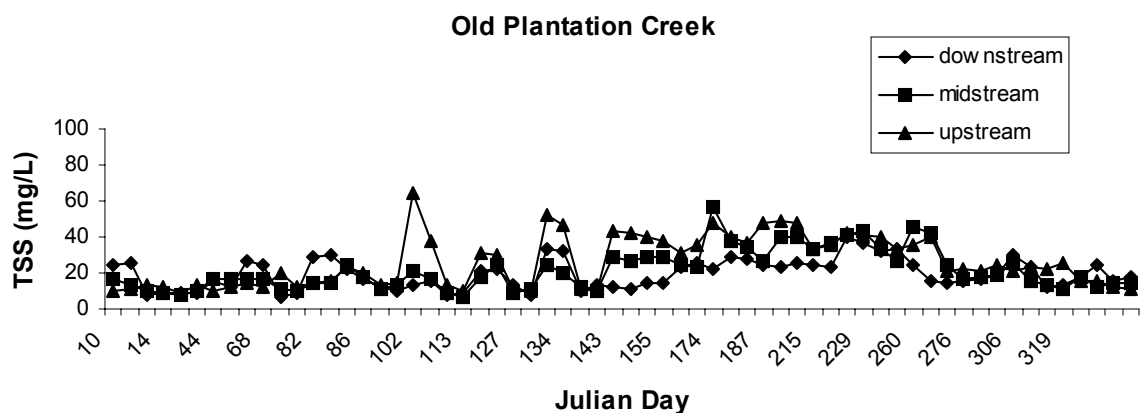
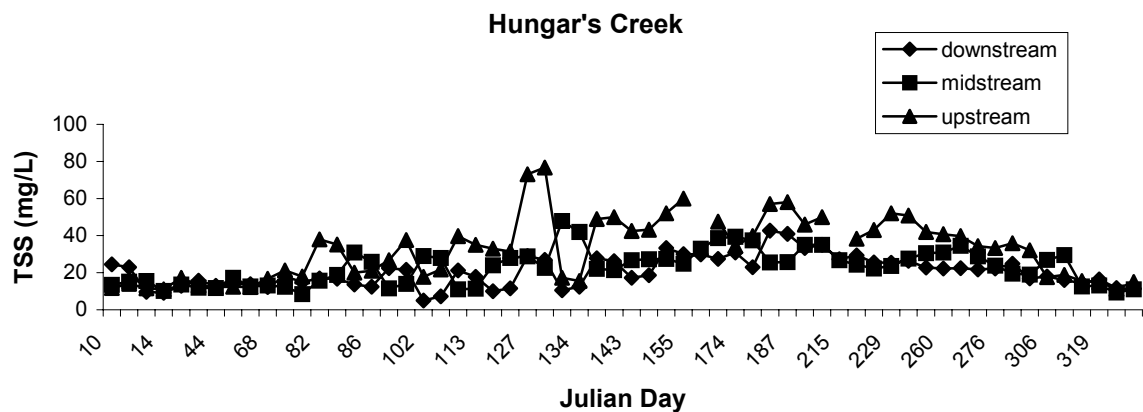
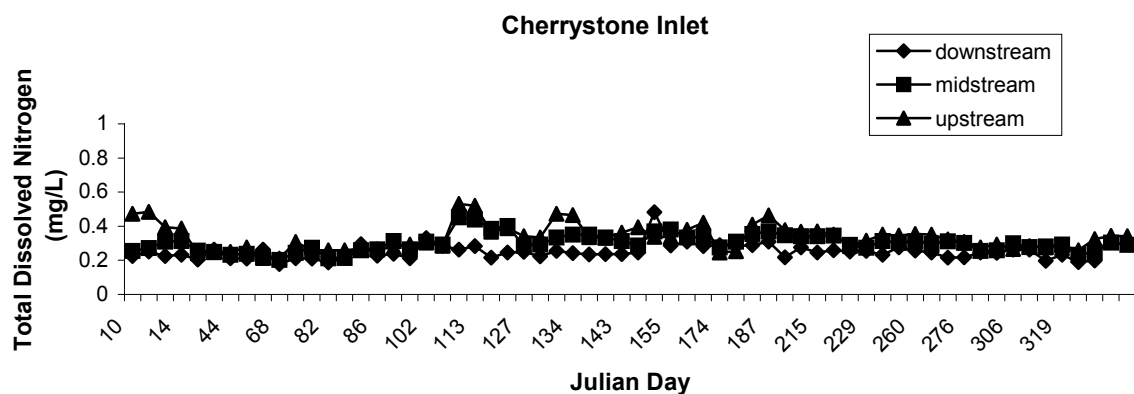
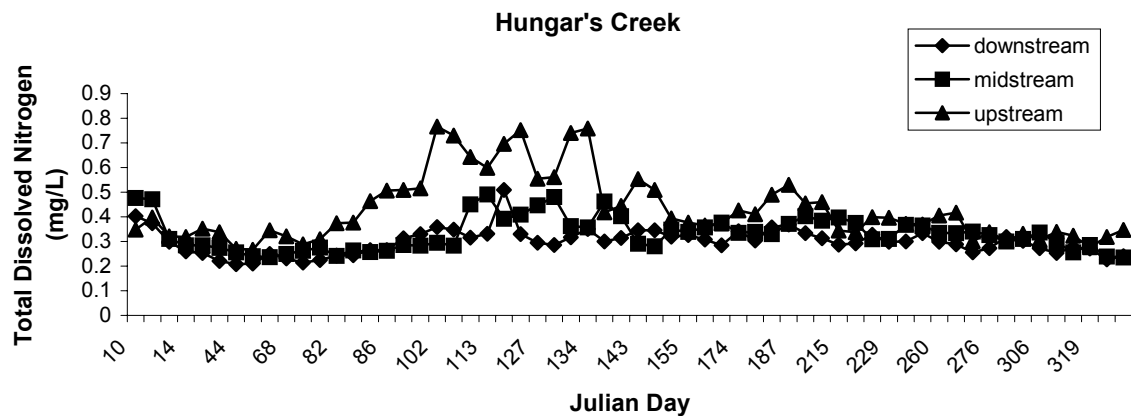


Figure 4. Total dissolved nitrogen by site. Values for each sample are represented.

a.



b.



c.

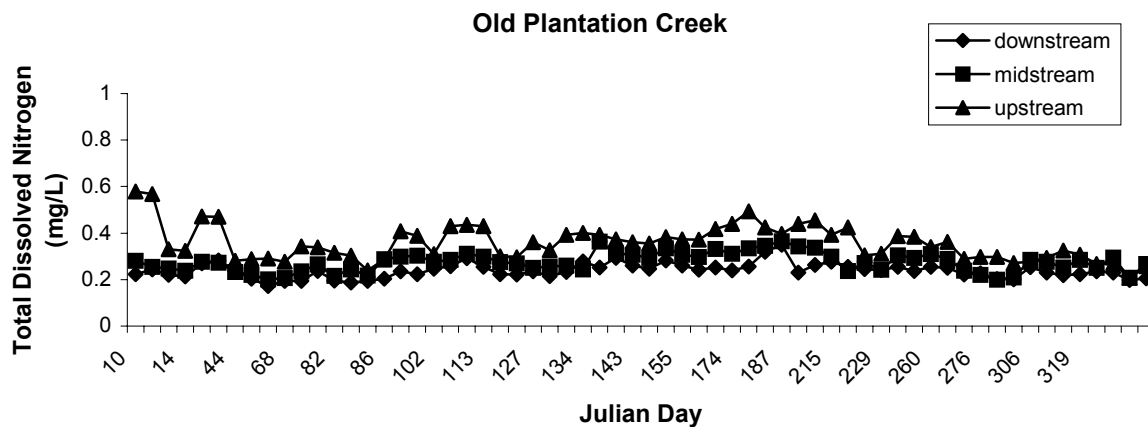
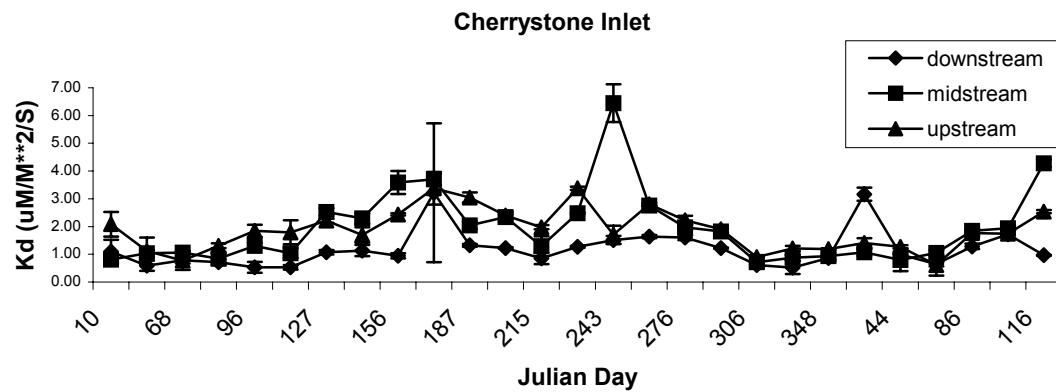
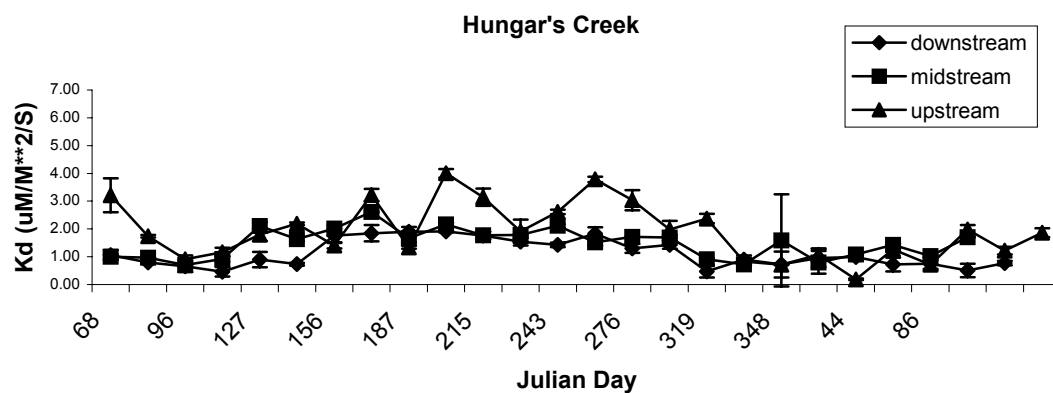


Figure 5. K_d values by site. Error bars represent \pm sd of three replicate measurements taken on each sampling date.

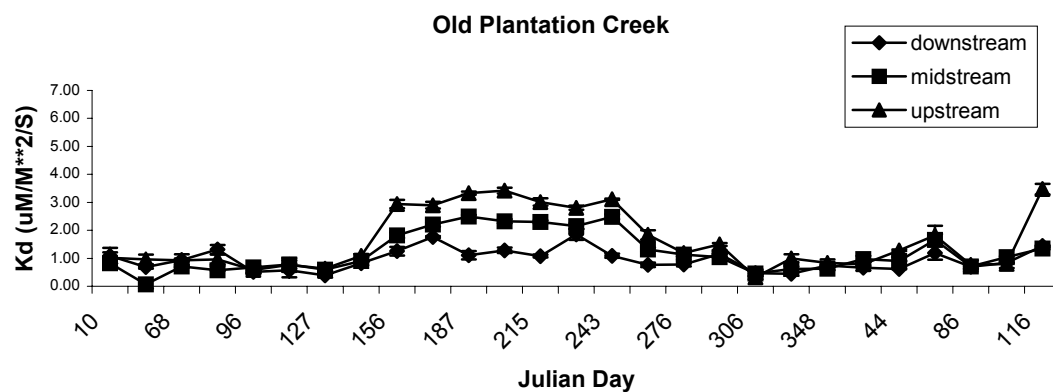
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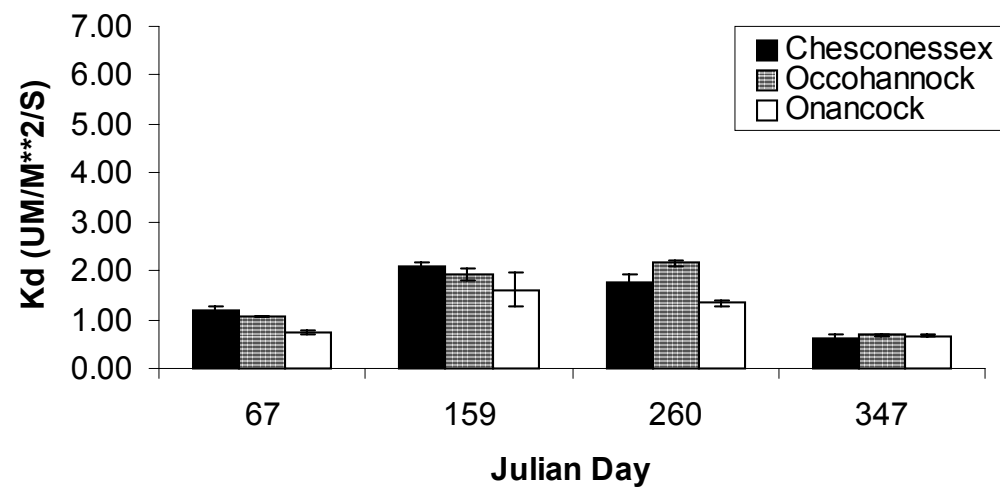
b.



c.



d. Northern Creeks



Groundwater monitoring

Because of the apparently strong influence of the watersheds on the tidal creeks, one long-term objective of our study is to evaluate the effects of groundwater input on nutrient levels in the tidal creeks. We initiated groundwater monitoring in January 2001 and included measurements on the following components: base flow, water table levels, and water quality in wells. Locations of wells are shown in Figure 1. Levels of some parameters were excessive, and water quality in some wells was severely contaminated with nitrate (Table 1). Groundwater data from current and past research, in conjunction with surrounding land use data, will be used to model effects of land use changes on water quality.

Table 1. Nutrient levels measured in water samples taken from wells in Northampton County, VA. Method detection limits are indicated under the parameter name and unit; “BMDL” indicates that the level of the parameter measured was below the method detection limit.

Date	Site	Transect	Well	NH3 mg/L 0.0015	NO2 mg/L 0.0002	NOX mg/L 0.0008	OP mg/L 0.0006	TDN mg/L 0.034	TDP mg/L 0.002	DON mg/L 0.034	DOP mg/L 0.002
4/16/2001	CR	2	4	0.0531	0.0005	11.972	0.0025	13.532	0.011	1.5075	0.0085
7/19/2001	CR	2	4	0.0098	0.0029	10.993	0.0045	10.816	0.0078	BMDL	0.0033
10/26/2001	CR	2	4	0.0104	0.0014	8.2724	0.0051	8.6605	0.0072	0.3777	0.0021
12/20/2001	CR	2	4	0.0122	0.0005	6.1952	0.0036	6.484	0.0045	0.2766	BMDL
12/20/2001	CR	3	1	0.069	0.0006	0.0875	0.0711	0.2177	0.0722	0.0612	BMDL
4/16/2001	CR	3	4	0.5346	0.0014	0.287	0.0259	0.9558	0.1489	0.1342	0.123
7/19/2001	CR	3	4	0.3549	0.0021	0.0794	0.0678	0.7401	0.2371	0.3058	0.1693
10/26/2001	CR	3	4	0.4184	0.0011	0.0075	0.0267	0.6637	0.0462	0.2378	0.0195
4/16/2001	CR	4	1	6.329	0.0035	0.0112	0.0008	6.2829	0.0051	BMDL	0.0043
7/19/2001	CR	4	1	6.1996	0.0019	0.0221	0.0016	7.6153	0.0047	1.3936	0.0031
10/26/2001	CR	4	1	7.7518	0.001	0.0187	0.0011	7.8294	0.0029	0.0589	BMDL
12/20/2001	CR	4	1	7.2976	0.0012	0.022	0.0007	7.528	0.004	0.2084	0.0033
4/16/2001	CR	4	4	5.0247	0.0028	0.0267	0.0016	5.4356	0.0208	0.3842	0.0192
7/19/2001	CR	4	4	5.1251	0.0025	0.0142	BMDL	6.2282	BMDL	1.0889	BMDL
10/26/2001	CR	4	4	7.284	0.0015	0.038	BMDL	7.5915	0.0097	0.2695	0.0096
12/20/2001	CR	4	4	0.4952	0.0007	0.001	0.2719	0.677	0.2755	0.1808	0.0036
4/16/2001	EH	1	1	0.0425	0.0004	1.2535	0.0012	1.5129	0.0032	0.2169	BMDL
7/19/2001	EH	1	1	0.0145	0.0011	1.3597	0.0016	1.6664	0.0035	0.2922	BMDL
10/26/2001	EH	1	1	0.0152	BMDL	2.0263	0.0022	2.3518	0.0042	0.3103	BMDL
12/20/2001	EH	1	1	0.0216	BMDL	2.041	0.0016	2.2425	0.0034	0.1799	BMDL
4/16/2001	EH	2	4	0.0156	0.0028	2.4085	0.0025	2.6609	0.0086	0.2368	0.0061
7/19/2001	EH	2	4	0.1871	0.0036	4.7419	0.0084	4.9341	0.0101	BMDL	BMDL
10/26/2001	EH	2	4	0.0101	0.0022	4.1729	0.0032	4.4929	0.0052	0.3099	BMDL
12/20/2001	EH	2	4	0.0157	0.0005	3.9037	0.0026	4.1083	0.0037	0.1889	BMDL
4/16/2001	EH	3	3	0.0329	0.0003	0.0282	BMDL	0.2846	0.0097	0.2235	0.0091
7/19/2001	EH	3	3	0.0923	0.0021	0.0513	0.0014	0.2144	0.0024	0.0708	BMDL
10/26/2001	EH	3	3	0.0253	0.0003	0.0132	0.0011	0.118	0.0028	0.0795	BMDL
12/20/2001	EH	3	3	0.0167	BMDL	0.0128	0.0011	0.0811	0.0025	0.0516	BMDL
4/16/2001	EH	4	1	0.0513	BMDL	6.2589	0.0011	7.0976	0.0152	0.7874	0.0141
7/19/2001	EH	4	1	0.0228	0.0012	6.1924	0.0031	6.2499	0.0052	0.0347	0.0021
10/26/2001	EH	4	1	0.0333	0.0004	7.6948	0.0038	8.2721	0.0059	0.544	0.0021
12/20/2001	EH	4	1	0.0078	BMDL	6.2271	0.0017	6.432	0.0033	0.1971	BMDL

Date	Site	Transect	Well	NH3 mg/L 0.0015	NO2 mg/L 0.0002	NOX mg/L 0.0008	OP mg/L 0.0006	TDN mg/L 0.034	TDP mg/L 0.002	DON mg/L 0.034	DOP mg/L 0.002
4/16/2001	EV	1	4	0.0326	0.0003	0.0085	0.001	0.1263	0.0042	0.0852	0.0032
7/19/2001	EV	1	4	0.0492	0.0017	0.01	0.0017	0.1465	0.0039	0.0873	0.0022
10/26/2001	EV	1	4	0.0347	0.0004	0.0117	0.0011	0.1102	0.0036	0.0638	0.0025
12/20/2001	EV	1	4	0.0285	0.0004	0.0123	0.0012	0.073	0.0028	BMDL	BMDL
4/16/2001	EV	2	1	0.0221	0.0003	1.1133	0.0079	1.5065	0.0112	0.3711	0.0033
7/19/2001	EV	2	1	0.0853	0.0088	8.5173	0.0204	8.5416	0.0223	BMDL	BMDL
10/26/2001	EV	2	1	0.0112	0.0003	0.7282	0.0117	0.8001	0.0137	0.0607	BMDL
12/20/2001	EV	2	1	0.0127	0.0005	7.5569	0.0082	7.795	0.0094	0.2254	BMDL
4/16/2001	EV	3	6	0.0378	0.0068	1.1438	0.0063	0.9191	0.0096	BMDL	0.0033
7/19/2001	EV	3	6	0.0136	0.0021	16.022	0.0073	17.679	0.008	1.643	BMDL
10/26/2001	EV	3	6	0.0253	0.0006	17.608	0.0062	20.977	0.0078	3.3434	BMDL
12/20/2001	EV	3	6	0.0137	0.0005	16.668	0.0049	17.796	0.0058	1.1144	BMDL
4/16/2001	EV	4	1	0.0387	BMDL	0.7078	0.0094	0.651	0.0115	BMDL	0.0021
4/16/2001	EV	4	1	0.0302	0.0004	0.2952	0.0101	0.6626	0.0119	0.3372	BMDL
7/19/2001	EV	4	1	0.0314	0.0014	0.7434	0.0409	0.8829	0.0413	0.1081	BMDL
10/26/2001	EV	4	1	0.0387	0.0005	0.4793	0.0296	0.545	0.032	BMDL	0.0024
12/20/2001	EV	4	1	0.0122	0.0004	0.3293	0.0154	0.4902	0.0157	0.1487	BMDL
7/19/2001	H	1		0.5289	0.0063	2.7343	0.3696	4.1366	0.7371	0.8734	0.3675
7/19/2001	H	5		0.0593	0.071	3.4647	0.0027	3.6121	0.0059	0.0881	0.0032
10/29/2001	H	5		0.0323	0.0014	7.2113	0.0058	7.3687	0.0087	0.1251	0.0029
12/6/2001	H	5		0.0122	0.0006	2.0196	0.0032	2.1665	0.0076	0.1347	0.0044
7/19/2001	H	6		0.0152	0.0012	0.0159	0.003	0.1049	0.0036	0.0738	BMDL
10/29/2001	H	6		0.009	0.0005	0.0049	0.0095	0.0693	0.0112	0.0554	BMDL
12/6/2001	H	6		0.01	0.0004	0.0026	0.0029	BMDL	0.0048	BMDL	BMDL
7/19/2001	H	7		0.0561	0.0012	0.0164	0.0014	0.1353	0.0038	0.0628	0.0024
10/29/2001	H	7		0.0521	0.0008	0.0312	0.0016	0.1876	0.005	0.1043	0.0034
12/6/2001	H	7		0.0439	0.0006	0.0335	0.0013	0.166	0.0094	0.0886	0.0081
7/19/2001	H	9		0.065	0.0013	5.6661	0.0016	5.7254	0.0038	BMDL	0.0022
7/19/2001	OP	1		0.0653	0.0039	6.3401	0.0034	6.6471	0.0045	0.2417	BMDL
10/29/2001	OP	1		0.0104	0.0014	3.0829	0.0039	3.2929	0.0064	0.1996	0.0025
12/6/2001	OP	1		0.0758	0.003	5.2022	0.0056	5.595	0.0055	0.317	BMDL
7/19/2001	OP	2		0.0837	0.003	0.0505	0.0045	0.3168	0.0069	0.1826	0.0024
10/29/2001	OP	2		0.0352	0.0006	0.1275	0.0039	0.2481	0.0086	0.0854	0.0047
7/19/2001	OP	3		0.0698	0.0033	0.6043	0.0019	0.8959	0.0049	0.2218	0.003
10/29/2001	OP	3		0.2027	0.0015	1.0267	0.0074	1.4996	0.0136	0.2702	0.0062
12/6/2001	OP	3		0.0788	0.003	0.7168	BMDL	1.0056	0.0037	0.21	0.0035
7/19/2001	OP	9		0.0222	0.0024	1.4649	0.001	1.6913	0.0038	0.2042	0.0028
10/29/2001	OP	9		0.1461	0.0005	0.0145	0.0019	0.3514	0.0096	0.1908	0.0077
7/19/2001	OP	10		0.1066	0.0014	0.1213	0.0077	0.2942	0.0108	0.0663	0.0031
10/29/2001	OP	10		0.0141	0.0005	0.165	0.0054	0.2775	0.0085	0.0984	0.0031
12/6/2001	OP	10		0.0325	BMDL	0.1148	0.0055	0.1948	0.009	0.0475	0.0035

Intensive study of Cherrystone Inlet watershed

Gauging stations

Under the current six-month grant from DEQ, we purchased equipment to establish four gauging stations in the Cherrystone Inlet watershed. Data from these stations will be used to help establish a nutrient budget for the watershed. Two of the stations have been installed and are collecting preliminary data. The remaining two stations will be installed within the next month so that all gauging stations can be monitored at the beginning of the water year in October 2002.

Time series sampling

Due to the drought and logistical problems with sites, we were unable to collect a series of water samples after a rainfall event and have rescheduled this work for the 2002-2003 period. Instead, we collected a series of samples simultaneously at two locations in the creek to assess consistency of nutrient levels over a tidal cycle. We also collected a series of samples at the mouth of Cherrystone Inlet that are needed to calibrate the model of the watershed. Data for these two events are not shown but are available upon request.

Collection of data by citizens

Epiphyte monitoring program

In collaboration with the Alliance for the Chesapeake Bay and the Eastern Shore Soil and Water Conservation District, we initiated a citizen-based epiphyte-monitoring program in the spring of 2001. Epiphyte monitoring data is being used by VIMS to calibrate models that predict the habitat suitability for potential seagrass restoration sites. We expect to have sufficient data after October 2002 to meet the objectives for the model. However, citizens who wish to continue their involvement may redirect their efforts to another aspect of water quality research or protection to be discussed at a citizens' summit scheduled for spring 2003.

Table 2. Summary of citizen monitoring activities associated with the Eastern Shore Tributary Strategy Program and Virginia's Eastern Shore Watersheds Network.

Creek	Epiphyte Monitoring	WQ Monitoring
Old Plantation	2001-2002	2001-2002
Cherrystone	2001-2002	x
Hungar's	2001-2002	2001-2002
Nassawadox	2001-2002	2001-2002
Pungoteague	X	2001-2002
Onancock	2001-2002	2001-2002
Chesconessex	X	2001

Data collected by citizen volunteers may be downloaded at: <http://www.acb-online.org/monitoring/site.cfm>.

Appendix 1. Summary statistics by site for water samples collected January 2001-June 2002. Parameters are in units of mg/L except CHL and PHEO, which are in ug/L. BMDL indicates that the minimum value was below the method detection limit. Statistics for data sets that included BMDL values were generated with Helsel's robust method and are indicated with an asterisk.

	NH3	NO2	NOX	OP	TDN	TDP	TSS	FSS	VSS	DON	DOP	CHLa	PHEO
Compiled													
Mean	0.0258	0.106*	0.942*	0.0067	0.3144	0.0170	25.98	20.10	5.887*	0.2754	0.759*	7.634*	2.419*
Variance	0.0025	0.024*	3.955*	0.0001	0.0079	0.0001	316.30	236.42	10.814*	0.0036	0.116*	48.494*	4.123*
Minimum	0.0018	BMDL	BMDL	0.0023	0.1720	0.0052	5.00	3.60	BMDL	0.1338	BMDL	BMDL	BMDL
Maximum	0.4221	0.0300	0.2729	0.1770	0.7666	0.0740	227.20	202.80	24.40	0.4985	0.0320	37.0000	13.1500
N	574	574	574	574	574	574	572	572	572	574	574	573	367
Cherrystone-downstream													
Mean	0.0121	0.0007	0.003*	0.0072	0.2488	0.0172	22.98	18.00	4.959*	0.2339	0.01*	5.0725	1.546*
Variance	0.0001	0.0000	0*	0.0000	0.0020	0.0001	191.99	131.90	12.15*	0.0016	0.002*	16.0435	0.752*
Minimum	0.0038	0.0003	BMDL	0.0025	0.1790	0.0072	7.20	5.80	BMDL	0.1695	BMDL	1.2300	BMDL
Maximum	0.0468	0.0048	0.0111	0.0420	0.4826	0.0740	96.70	79.00	21.40	0.4323	0.0320	24.3500	3.6800
N	60	60	60	60	60	60	60	60	60	60	60	60	38
Cherry-midstream													
Mean	0.0179	0.001*	0.006*	0.0063	0.3011	0.0186	32.88	26.10	6.76	0.2769	0.0122	10.3739	3.311*
Variance	0.0005	0*	0.006*	0.0000	0.0027	0.0000	422.19	324.48	9.58	0.0019	0.0000	45.4402	4.466*
Minimum	0.0041	BMDL	BMDL	0.0025	0.2025	0.0098	7.70	4.70	2.20	0.1973	0.0010	1.7600	BMDL
Maximum	0.0917	0.0062	0.0443	0.0121	0.4518	0.0324	116.50	99.20	17.30	0.3689	0.0240	34.9900	7.6600
N	62	62	62	62	62	62	62	62	62	62	62	62	40
Cherrystone-upstream													
Mean	0.0272	0.002*	0.014*	0.0063	0.3336	0.0185	37.65	30.56	7.091*	0.2926	0.0122	9.405*	1.972*
Variance	0.0008	0*	0.057*	0.0000	0.0055	0.0001	1173	955.20	13.94*	0.0035	0.0000	46.62*	5.083*
Minimum	0.0052	BMDL	BMDL	0.0024	0.2108	0.0081	12.00	8.30	BMDL	0.2049	0.0024	BMDL	BMDL
Maximum	0.0997	0.0063	0.1479	0.0125	0.5311	0.0402	227.20	202.80	24.40	0.4550	0.0293	37.0000	13.1500
N	62	62	62	62	62	62	62	62	62	62	62	62	40

	NH3	NO2	NOX	OP	TDN	TDP	TSS	FSS	VSS	DON	DOP	CHLa	PHEO
Chesconessex													
Mean	0.0230	0.0011	0.01*	0.0061	0.3283	0.0146	24.46	17.58	6.89	0.2958	0.0084	4.6500	0.9725
Variance	0.0003	0.0000	0.003*	0.0000	0.0052	0.0000	46.90	32.07	6.27	0.0063	0.0000	8.8092	0.1480
Minimum	0.0053	0.0003	BMDL	0.0044	0.2421	0.0087	16.40	10.00	3.20	0.1890	0.0033	0.9100	0.6000
Maximum	0.0481	0.0019	0.0175	0.0094	0.4417	0.0221	35.00	25.00	10.00	0.4262	0.0127	9.0000	1.3100
N	8	8	8	8	8	8	8	8	8	8	8	8	4
Hungar's-downstream													
Mean	0.0192	0.0012	0.01*	0.0056	0.2987	0.0149	20.47	15.63	4.9*	0.2697	0.0093	5.026*	1.76*
Variance	0.0003	0.0000	0.019*	0.0000	0.0028	0.0000	68.25	45.06	4.099*	0.0020	0.0000	12.775*	1.426*
Minimum	0.0018	0.0003	BMDL	0.0025	0.2082	0.0093	5.00	4.40	BMDL	0.2007	0.0010	BMDL	BMDL
Maximum	0.0746	0.0044	0.0883	0.0109	0.5097	0.0256	42.70	33.30	9.70	0.4594	0.0198	13.2400	4.8200
N	60	60	60	60	60	60	60	60	60	60	60	60	40
Hungar's-midstream													
Mean	0.0270	0.001*	0.015*	0.0054	0.3320	0.0151	23.00	17.32	5.62	0.2897	0.01*	7.1347	2.2520
Variance	0.0012	0*	0.066*	0.0000	0.0048	0.0000	86.87	62.81	5.12	0.0025	0.001*	20.3536	3.2380
Minimum	0.0045	BMDL	BMDL	0.0025	0.2345	0.0076	8.50	5.30	1.00	0.2100	BMDL	0.9300	0.5600
Maximum	0.1255	0.0071	0.1654	0.0108	0.4909	0.0281	47.80	40.50	10.70	0.3849	0.0229	17.1800	8.3500
N	60	60	60	60	60	60	60	60	60	60	60	60	38
Hungar's-upstream													
Mean	0.0892	0.0039	0.023*	0.0084	0.4307	0.0159	32.34	24.90	7.45	0.3183	0.0102	10.3285	3.253*
Variance	0.0155	0.0000	0.042*	0.0005	0.0182	0.0000	276.69	202.08	10.91	0.0039	0.0000	85.0939	4.662*
Minimum	0.0064	0.0003	BMDL	0.0025	0.2657	0.0087	11.00	3.60	2.50	0.1951	0.0021	0.9700	BMDL
Maximum	0.4221	0.0300	0.1151	0.1770	0.7666	0.0311	76.70	65.00	16.30	0.4985	0.0231	52.7100	8.1300
N	60	60	60	60	60	60	58	58	58	60	60	60	40

	NH3	NO2	NOX	OP	TDN	TDP	TSS	FSS	VSS	DON	DOP	CHLa	PHEO
Occhannock													
Mean	0.0495	0.002*	0.0253	0.0083	0.3883	0.0143	20.50	11.49	9.01	0.3135	0.0060	14.7150	1.8800
Variance	0.0050	0*	0.0007	0.0000	0.0072	0.0001	89.98	33.22	20.80	0.0146	0.0000	58.9494	0.1011
Minimum	0.0064	BMDL	0.0013	0.0037	0.3073	0.0076	10.80	4.40	3.20	0.1338	0.0035	3.6600	1.4400
Maximum	0.1791	0.0071	0.0660	0.0199	0.5468	0.0286	34.00	20.30	13.70	0.4703	0.0095	22.7700	2.2000
N	8	8	8	8	8	8	8	8	8	8	8	8	4
Onancock													
Mean	0.0266	0.0015	0.0372	0.0078	0.3507	0.0156	15.53	8.49	7.04	0.2870	0.008*	9.4613	3.1760
Variance	0.0008	0.0000	0.0018	0.0000	0.0015	0.0000	38.74	12.12	9.61	0.0051	0.001*	7.9194	0.3080
Minimum	0.0085	0.0003	0.0011	0.0036	0.3046	0.0052	6.50	3.70	2.80	0.2106	BMDL	6.1000	BMDL
Maximum	0.0750	0.0029	0.0979	0.0123	0.4183	0.0230	26.90	14.80	12.10	0.4066	0.0107	12.8600	3.8600
N	8	8	8	8	8	8	8	8	8	8	8	8	4
	NH3	NO2	NOX	OP	TDN	TDP	TSS	FSS	VSS	DON	DOP	CHLa	PHEO
Old Plantation-downstream													
Mean	0.0142	0.001*	0.004*	0.0081	0.2387	0.0168	19.35	15.41	3.972*	0.2204	0.009*	3.0910	1.165*
Variance	0.0001	0*	0.001*	0.0000	0.0010	0.0000	67.48	46.50	3.304*	0.0009	0.001*	6.2520	1.16*
Minimum	0.0041	BMDL	BMDL	0.0023	0.1720	0.0073	6.70	4.60	BMDL	0.1499	BMDL	0.2500	BMDL
Maximum	0.0413	0.0031	0.0234	0.0158	0.3504	0.0379	39.70	31.00	8.70	0.3234	0.0223	9.3800	5.2900
N	62	62	62	62	62	62	62	62	62	62	62	61	40
Old Plantation-midstream													
Mean	0.0119	0.001*	0.008*	0.0064	0.2750	0.0172	21.39	16.79	4.657*	0.2550	0.011*	5.685*	2.298*
Variance	0.0001	0*	0.009*	0.0000	0.0017	0.0000	126.45	80.99	7.049*	0.0018	0.001*	30.975*	3.286*
Minimum	0.0024	BMDL	BMDL	0.0024	0.1994	0.0095	6.60	5.00	BMDL	0.1750	BMDL	BMDL	BMDL
Maximum	0.0544	0.0051	0.0410	0.0185	0.3652	0.0318	56.40	42.20	14.20	0.3558	0.0220	21.9000	6.7700
N	62	62	62	62	62	62	62	62	62	62	62	62	40
Old Plantation-upstream													
Mean	0.0123	0.0015	0.001*	0.0059	0.3568	0.0192	26.04	19.12	6.914*	0.3132	0.0133	11.662*	3.576*
Variance	0.0001	0.0000	0*	0.0000	0.0057	0.0001	199.51	111.93	17.983*	0.0046	0.0000	106.384*	7.608*
Minimum	0.0026	0.0003	BMDL	0.0023	0.2075	0.0096	9.20	6.10	BMDL	0.1897	0.0025	BMDL	BMDL
Maximum	0.0460	0.0049	0.2729	0.0154	0.5790	0.0390	64.20	51.20	17.50	0.4819	0.0285	37.1500	11.6100
N	62	62	62	62	62	62	62	62	62	62	62	62	40

Appendix C – Eastern Shore Tributary Strategy Input Decks

Nonpoint Source Input Deck

Eastern Shore Tributary Strategy: 2010 BMP Implementation

Best Management Practice	Land Use	Units	Amount
AGRICULTURAL PRACTICES:			
Animal Waste Management Systems/Barnyard Runoff Control	manure	systems	7
Conservation Plans	hi-till	acres	3,261
Conservation Plans	low-till	acres	61,982
Conservation Plans	hay	acres	156
Conservation Plans	pasture	acres	1,777
Conservation Tillage	hi-till	acres	61,984
Cover Crops (early planting)	hi-till	acres	1,859
Cover Crops (early planting)	low-till	acres	58,723
Forested Buffer	hi-till	acres	8,156
Forested Buffer	low-till	acres	0
Forested Buffer	hay	acres	23
Forested Buffer	pasture	acres	234
Grassed Buffer	hi-till	acres	8,156
Grassed Buffer	low-till	acres	0
Horse Pasture Management	mixed open	acres	0
Nutrient Management Plans	hi-till	acres	1,859
Nutrient Management Plans	low-till	acres	61,982
Nutrient Management Plans	hay	acres	150
Off-Stream Watering with Fencing	pasture	acres	374
Off-Stream Watering without Fencing	pasture	acres	187
Off-Stream Watering with Fencing and Rotational Grazing	pasture	acres	374
Retirement of Highly Erodible Land	hi-till	acres	0
Retirement of Highly Erodible Land	low-till	acres	0
Retirement of Highly Erodible Land	hay	acres	0
Tree Planting	hi-till	acres	0
Tree Planting	low-till	acres	0
Tree Planting	hay	acres	23
Tree Planting	pasture	acres	234
Wetland Restoration	hi-till	acres	0
Wetland Restoration	low-till	acres	0
Wetland Restoration	hay	acres	23
Yield Reserve	hi-till	acres	1,305
Yield Reserve	low-till	acres	0
Yield Reserve	hay	acres	3

NON-AGRICULTURAL PRACTICES:			
Erosion and Sediment Control	pervious urban	acres	3,767
Erosion and Sediment Control	impervious urban	acres	0
Filtering Practices	pervious urban	acres	897
Filtering Practices	impervious urban	acres	711
Forested Buffer	mixed open	acres	1,903
Forested Buffer	pervious urban	acres	628
Forest Harvesting Practices	forest	acres	315
Infiltration Practices	pervious urban	acres	897
Infiltration Practices	impervious urban	acres	829
Mixed Open Nutrient Management Plans	mixed open	acres	12,658
Septic Connections	septic	systems	0
Septic Denitrification	septic	systems	688
Septic Pumping	septic	systems	5,157
Tree Planting	mixed open	acres	1,903
Tree Planting	pervious urban	acres	628
Urban Nutrient Management Plans	pervious urban	acres	3,947
Wetland Restoration	mixed open	acres	1,903
Wet Ponds and Wetlands	pervious urban	acres	897
Wet Ponds and Wetlands	impervious urban	acres	828

Point Source Input Deck

	WSM	Design Flow	Trib Strat 2010 Flow	Trib Strat TN Conc	Proposed 2010 TN Load	Trib Strat TP Conc	Proposed 2010 TP Load
Facility	Segment	(MGD)	(MGD)	(mg/l)	(lbs/yr)	(mg/l)	(lbs/yr)
Cape Charles STP	440	0.25	0.15	8.0	3,655	0.50	228
Onancock STP	440	0.25	0.23	8.0	5,604	0.50	350
E. Shore Health Serices	440	0.10	0.06	8.0	1,462	0.50	91
Tangier STP	440	0.10	0.06	5.26	1,462	0.50	91
Tysons-Temperenceville	440	0.98	1.05	57.0	182,286	1.00	3,198
Totals 440 =		1.68	1.55		194,489		3,959

Appendix D – Eastern Shore Tributary Strategy Team

- Virginia Cooperative Extension- NH County
- Virginia Cooperative Extension- AC County
- Eastern Shore Soil & Water Conservation District
- Accomac-Northampton Planning District Commission
- Northampton County Planning Department
- Citizens for a Better Eastern Shore
- ShoreKeepers
- Tysons Food, Inc.
- Chesapeake Bay Foundation
- The Nature Conservancy
- Tangier Residents
- Pungoteague Residents
- Cape Charles Residents
- Locustville Residents
- Farmers
- Virginia Institute for Marine Science
- Virginia Dept. of Game and Inland Fisheries
- Virginia Department of Transportation
- Virginia Department of Environmental Quality
- Virginia Department of Conservation and Recreation
- Virginia Dept. of Agricultural and Consumer Services

Stakeholder participation during this revision process involved several public meetings and workgroup meetings. The revision meeting schedule was as follows:

Date	Location
July 29, 2003	Exmore VA (Eastern Shore Community College)
September 11, 2003	Painter VA, (Agricultural Research Center)
October 9, 2003	Best Management Practice Workgroup – Accomac, VA (NRCS Service Center)
November 5, 2003	Best Management Practice Workgroup – Accomac, VA (NRCS Service Center)
November 18, 2003	Melfa, VA (Eastern Shore Chamber of Commerce)
January 20, 2004	Painter VA, (Agricultural Research Center)
March 11, 2004	Painter VA, (Agricultural Research Center)

Appendix E – Virginia Partnership

Virginia partnership

Chesapeake Bay 2000 Agreement commitments require an unprecedented level of communication, consultation and coordination among federal, state and local governments as well as community and watershed organizations. These interactions relative to the 2000 agreement are well established between state and federal agencies.

Effective and sustainable connections with local governments and other organizations within a regional perspective are, however, still emerging. In addition to the state and federal partnerships, many effective state agency relationships exist with individual local governments relative to specific agency programs. Further, the Virginia Association of Counties and the Virginia Municipal League provide contacts among localities statewide. All of these relationships, while effective for their initial purpose, do not address the need for more extensive and effective watershed level communication and coordination.

The existing regional connections, in place Bay-wide, that support Bay agreement related local involvement include planning district commissions, watershed conservation roundtables, soil and water conservation districts. These regional entities, depending on location and level of involvement, perform various communication and coordination activities, some collectively and others individually.

Bay-wide coordination

Virginia Secretary of Natural Resources – The Office of the Secretary oversees state agencies within its purview to make sure resources and programs are well coordinated. This is done through direct interaction of agency heads across the full spectrum of natural resource issues.

Virginia Watershed Planning and Permitting Task Force – The task force consists of directors, or their designees, from the Department of Environmental Quality (DEQ), Department of Conservation and Recreation (DCR), Department of Forestry (DOF), Department of Mines Minerals and Energy (DMME), Chesapeake Bay Local Assistance Department (CBLAD), and the commissioner, or his designee, of Department of Agriculture and Consumer Services (DACS). "The task force shall undertake such measures and activities it deems necessary and appropriate to see that the functions of the agencies represented therein, and to the extent practicable of other agencies of the Commonwealth, and the efforts of state and local agencies and authorities in watershed planning and watershed permitting are coordinated and promoted." (§ 10.1-1194)

Nonpoint Source Advisory Committee (NPSAC) – This committee was formed in the 1980s to bring about a coordinated statewide approach to nonpoint source pollution control programs. It is chaired by DCR, Virginia's lead nonpoint source agency. A variety of state and federal agencies serve on the committee, all of which have significant nonpoint source water quality responsibilities.

Members include staff from DEQ, Virginia Marine Resource Commission (VMRC), Department of Game and Inland Fisheries (DGIF), DOF, DACS, CBLAD, Virginia Department of Transportation (VDOT), Virginia Cooperative Extension Service (VCES), U.S.D.A. Natural Resources Conservation Service and the U.S. Geological Survey. The committee guides implementation of the Virginia's Nonpoint Source Management Program, a strategy required under the Clean Water Act to ensure that states give a high priority to the water quality problems resulting from runoff and other diffuse sources.

Because of NPSAC's meetings and grant review activities, state and federal agency members pursue partnerships with other groups and organizations working to prevent nonpoint source pollution.

Virginia Chesapeake Bay Interagency Workgroup – This workgroup consists of technical and managerial staff from the critical state agencies that help implement the ***Chesapeake 2000*** agreement. It is further supported by intra-agency workgroups established by the agencies as needed.

Virginia Association of Counties (VACo) and Virginia Municipal League (VML) – VACo and VML are associations of Virginia cities, towns and counties. The groups foster a wide range of communication and coordination among the localities. Both engage in local government representation, advocacy and education. The Chesapeake Bay Program is an area of common interest to these groups, hence they are engaged in the process described above.

Regional coordination

Planning District Commissions (PDCs) – These are legally constituted under the Regional Cooperation Act as political subdivisions and formally established by the local governments in defined areas. Twenty-one PDCs have been established and have been in operation for 30 years or more. Approximately 14 PDCs are wholly within the Chesapeake Bay watershed. These regional entities are formed and operate within political boundaries. PDCs function to inform and receive collective input from local governments and transfer information. Specifically, PDCs' statutory duties are to:

- Conduct studies on issues and problems of regional significance.
- Identify and study potential opportunities for state and local cost saving...through coordinated government efforts.
- Identify mechanisms for the coordination of state and local interests.
- Serve as liaison between localities and state agencies.
- Conduct strategic planning for its region.
- Develop regional functional area plans.
- Help state agencies, on request, write local and regional plans.

All of these duties support and are consistent with finding ways to realistically address the major dependence of the ***Chesapeake 2000*** agreement on local governments for successful, long-term implementation of the that agreement.

Watershed Conservation Roundtables – Established under the Water Quality Improvement Act, Nonpoint Source Cooperative Programs have been underway since early 1999. These voluntary groups, or roundtables, consist of stakeholders, local governments, community and watershed organizations, and other community interests that discuss and address watershed stewardship issues. The primary role of roundtables at this point is to provide advice to state agencies and to increase coordination among the active stakeholders on watershed based initiatives. Roundtables, while authorized under the WQIA, are not legally constituted and consequently are not afforded distinct functions beyond an advisory role.

Local Government Activities Supporting Implementation of the Agreement – Local governments obviously play a key role in the Chesapeake 2000 Bay Agreement, as they do for most other significant environmental enhancement efforts. Legislators and other interests generally are aware of the range of activities carried out by local governments. The following is a list of routine activities that contribute directly to implementation of the Bay agreement.

- Meeting applicable provisions of the Chesapeake Bay Preservation Act
- Meeting provisions of the state Erosion and Sediment Control Act
- Meeting DEQ permit requirements, such as complying with sewage treatment plant effluent limitations and other regulated discharges
- Complying with Safe Drinking Water Act provisions
- Meeting provisions of the Virginia wetlands programs
- Carrying out floodplain management
- Adopting and implementing stormwater management measures
- Conducting activities through the local Soil and Water Conservation Districts